

ALTIVAR® 58 TRX AC DRIVES

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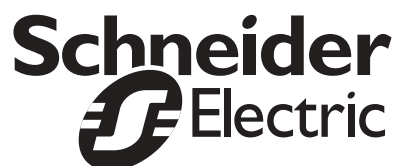
Catalog

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CONTENTS

Description	Page
Drives Product Support and Contacts	2
Altivar® 58 TRX AC Drives	3
Class 8839 58M Enclosed AC Drives	143
Class 8839 Econoflex™ AC Drives	185
Class 8998 Motor Control Centers	211



DRIVES PRODUCT SUPPORT AND CONTACTS

Drives Product Support Group

The Product Support Group is available 24 hours a day, 365 days a year. We will work with you over the telephone to diagnose application or product problems and to advise the correct course of action.

Telephone: 919-266-8600
Fax: 919-217-6508
E-mail: drivepsg@SquareD.com

Field Services

Square D Field Services is committed to providing quality on-site service. No matter how routine or complex the task, we have the engineering and technical expertise to provide service for any manufacturer's equipment. Our coordination center will respond to your requests 24 hours a day, seven days a week. Simply call our toll-free number to arrange on-site service.

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Training

Square D offers a variety of *instructor-led* and *self-paced* skill enhancing and product training programs for our employees, distributors, customers, and suppliers. For more information, call the Square D Organizational Development Department.

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Conditions of Sale

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Customer Information Center

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Customer Literature Center

To obtain hard copy support literature for your product or application needs, contact the Square D Customer Literature Center.

Telephone: 800-392-8781
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Square D Website

Visit the virtual work zone at the Square D website to quickly find and download technical literature and marketing collateral. The website offers a variety of solutions for your drive applications. It includes software tools, new product information, and product selection information.

Web Address: <http://www.SquareD.com>

Square D/Schneider Electric Sales Offices

Visit www.SquareD.com for the location of the sales office nearest you.



Altivar 58 TRX AC Drives

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DESCRIPTION	PAGE
PRODUCT OVERVIEW	4
USER INTERFACE OPTIONS AND ACCESSORIES	5
ATV58 TRX TYPE H DRIVE CONTROLLERS	7
ATV58 TRX TYPE E DRIVE CONTROLLERS	12
ATV58 TRX TYPE F DRIVE CONTROLLERS	13
ATV58 TRX TYPE N DRIVE CONTROLLERS	14
ATV58 TYPE FVC DRIVE CONTROLLERS	15
TERMINAL LOCATIONS FOR ATV58 TRX TYPE H AND TYPE FVC DRIVES	18
DESCRIPTION OF POWER TERMINALS	20
CONDUIT CONNECTIONS FOR TYPE E AND TYPE F DRIVE CONTROLLERS	20
DESCRIPTION OF CONTROL TERMINALS	21
DESCRIPTION OF ATV58 TYPE FVC CONTROL TERMINALS	22
KEYPAD DISPLAY	23
POWERSUITE OPTION	25
MAGELIS TERMINAL	25
SUMMARY OF USER INTERFACE OPTIONS	26
I/O EXTENSION CARDS	26
COMMUNICATION OPTIONS	32
VENTILATION KITS	33
CONDUIT ENTRY KITS	33
DYNAMIC BRAKING RESISTOR KITS	34
ELECTROMAGNETIC COMPATIBILITY (EMC) KITS	38
RFI FILTERS	38
LINE REACTORS	39
MOTOR PROTECTING OUTPUT FILTERS	39
MACRO-CONFIGURATION PROGRAMMING	40
DRIVE CONTROLLER IDENTIFICATION SCREEN:	40
DISPLAY PARAMETERS	41
ADJUSTMENT PARAMETERS	42
DRIVE AND MOTOR CONFIGURATION PARAMETERS	44
DRIVE CONTROL PARAMETERS	49
CONFIGURABLE I/O FUNCTIONS	50
FUNCTION COMPATIBILITY	52
ASSIGNMENT OF LOGIC INPUTS (Lix)	53
ASSIGNMENT OF ANALOG INPUTS (Aix)	57
ASSIGNMENT OF ANALOG INPUTS (Aix) WITH ANALOG I/O EXTENSION CARD	60
ASSIGNMENT OF LOGIC OUTPUTS (R2 OR LOx)	61
ASSIGNMENT OF ANALOG OUTPUTS (AOx)	63
FAULT MANAGEMENT PARAMETERS	65
ADDITIONAL FUNCTIONALITY PROVIDED IN THE ATV58 TYPE FVC DRIVE	68
ATV58 TYPE FVC ADJUSTMENT PARAMETERS	69
ATV58 TYPE FVC ANALOG INPUTS	72
ATV58 TYPE FVC ANALOG OUTPUTS	73
ATV58 TYPE FVC LOGIC OUTPUTS	73
PARAMETER SUMMARY	74
MENU OVERVIEW	76
COMMUNICATION PARAMETERS	78
POWER SECTION CONSTRUCTION INFORMATION	92
PERFORMANCE INFORMATION (CONSTANT TORQUE RATED PRODUCTS)	95
SPEED REGULATION (CONSTANT TORQUE RATED PRODUCTS)	97
INSTALLATION RECOMMENDATIONS	97
WIRING RECOMMENDATIONS	100
ATV58 TRX TYPE H SPECIFICATIONS	115
ATV58 TRX TYPE FVC SPECIFICATIONS	118
DIMENSIONS	120
WEIGHTS	126
SELECTION	127
SUGGESTED SPECIFICATIONS FOR ATV58 TRX TYPE H CONTROLLERS	137

Altivar® 58 TRX AC Drives Product Overview



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ATV58 TRX Type H Product Family

PRODUCT OVERVIEW

Altivar® 58 (ATV58) TRX AC drive controllers offer superior performance in a compact package. ATV58 TRX drive controllers are designed for modularity, allowing you to customize the product to your exact needs. A variety of multilingual operator interface options, I/O extension cards, communication cards, and hardware options are available.

ATV58 TRX drive controllers incorporate sensorless flux vector control for three-phase asynchronous squirrel cage AC motors. They are available in the following configurations:

- Type H
- Type FVC
- Type E
- Type F
- Type N



ATV58Family.tif

ATV58 Type FVC Product Family

The ATV58 TRX Type H drive controller can be used in variable torque or constant torque applications. Each ATV58 TRX drive controller incorporates random switching frequency modulation to reduce motor noise. For variable torque applications, the ATV58 TRX Type H controller includes features for additional energy savings and quiet motor operation. For constant torque applications, the ATV58 TRX Type H drive controller features a 1:100 speed range with excellent torque performance through the entire range.

The ATV58 Type FVC drive controller offers the highest level of AC drive performance. It is for use in constant torque applications requiring a 1:1000 speed range and torque at zero speed, or where response time to a change in load is critical to the application.

The Type H and Type FVC drive controllers can be mounted in an enclosure integrating other equipment, or wall-mounted using the optional conduit entry kits.

The Type E, Type F, and Type N configurations offer a packaged product ready to mount in a variety of environments.

- The ATV58 TRX Type E drive controller is Type 1 rated and has an integrated output contactor.
- The ATV58 TRX Type F drive controller is Type 12 rated and contains integrated line fuses.
- The ATV58 TRX Type N drive controller is Type 4/4X rated.

Each ATV58 TRX drive controller has an integrated RS-485 port. This port has a variety of uses to fit your application requirements, including:

- Use as a multidrop Modbus® port
- Connection for a keypad
- Connection for Magelis® terminals
- Connection of PC or Pocket PC commissioning software



TypeE_Family.tif

ATV58 TRX Type E and Type F Product Family



TypeN_Family.tif

ATV58 TRX Type N Product Family

Altivar® 58 TRX AC Drives User Interface Options and Accessories

USER INTERFACE OPTIONS AND ACCESSORIES



Keypad Display (Left) and Remote Mounting Kit (Right)

Keypad Display

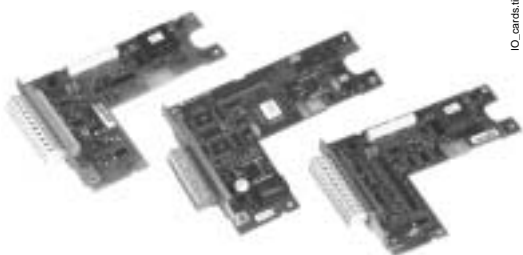
The operator keypad display can be mounted directly to the drive or connected via a remote mounting kit. It can be used to operate the drive, or to display, configure, and adjust parameters. It can also be used to upload and download configurations.



PowerSuite Software

PowerSuite™ Software

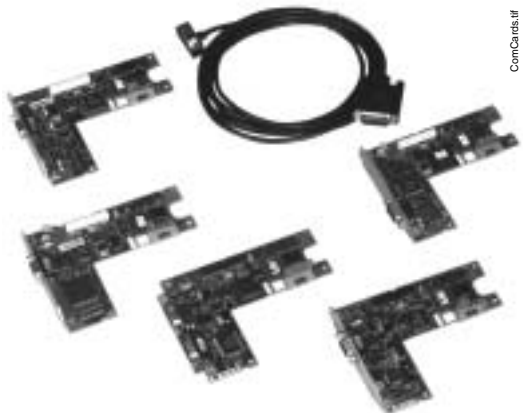
This Windows®-based PC and Pocket PC software can be used to display, configure, and adjust parameters as well as upload and download configurations. It can also be used to operate the drive and view fault history. The software may be used in a stand-alone mode to create or modify a configuration and transfer it to an ATV58 TRX drive controller.



I/O Option Boards

I/O Option Boards

A variety of option boards are available to expand the I/O to match the needs of the installation. The option boards mount internally without requiring additional panel space.

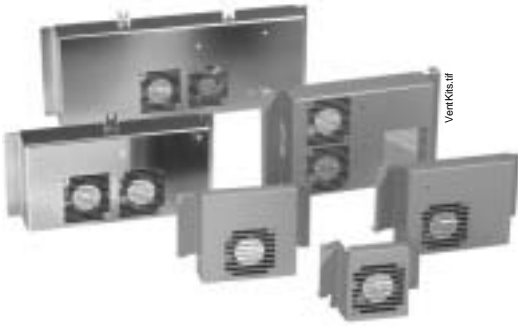


Communication Option Boards

Communication Option Boards

Individual communication cards are available to integrate the ATV58 TRX drive controller into many industrial and building automation communication protocols. These allow the user to control, adjust, and obtain the status of an ATV58 TRX drive controller. The communication card mounts internally without requiring additional space.

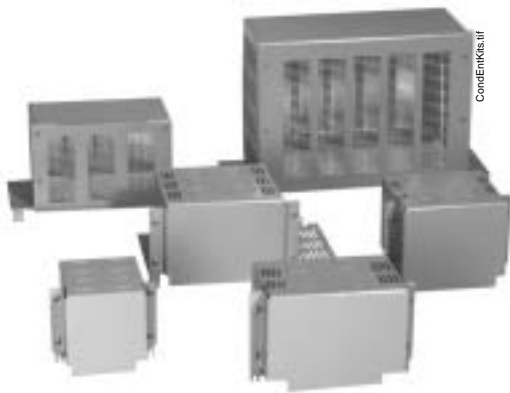
Altivar® 58 TRX AC Drives User Interface Options and Accessories



Ventilation Kits

Ventilation fan kits are available for packaging the drive in a smaller enclosure. The ventilation fan is powered internally and mounts on top of the ATV58 TRX drive controller without requiring additional panel space.

Ventilation Kits



Conduit Entrance Kits

Conduit entrance kits are available for wall-mount applications. The kits attach to the bottom of the ATV58 TRX drive controller and are provided with multiple conduit knockouts.

Conduit Entrance Kits



Dynamic Braking Resistor Kits

Dynamic braking resistors packaged in Type 1 enclosures are available for applications requiring fast cycle times. These kits mount separately.

Dynamic Braking Resistor Kits

ATV58 TRX TYPE H DRIVE CONTROLLERS

Features

The ATV58 TRX Type H drives are used for controlling three-phase asynchronous motors ranging from:

- 1 to 350 hp CT (1 to 500 hp VT), 400/460 Vac, three-phase input
- 0.5 to 7.5 hp CT (0.5 to 30 hp VT), 208/230 Vac, single-phase input
- 2 to 40 hp CT (2 to 50 hp VT), 208/230 Vac, three-phase input

The ATV58 TRX Type H drive controller uses the latest in AC drive technology. Power modules are used on the entire product family. The modules contain insulated gate bipolar transistors (IGBTs) to produce a pulse width modulated (PWM) output waveform to the motor. The power modules minimize part count and improve reliability.

The Type H drive controllers integrate third-generation sensorless flux vector control for three-phase asynchronous squirrel cage AC motors. This allows the drive controller to deliver needed torque with excellent dynamic response over a wide speed range.

ATV58 TRX Type H drive controllers are capable of:

- Producing transient torque of 200% ($\pm 10\%$) of nominal motor torque for 2 seconds
- Producing transient torque of 170% ($\pm 10\%$) of nominal motor torque for 60 seconds
- Producing 160% of rated motor torque at 0.6 Hz with encoder feedback, or at 1 Hz without tachometer or encoder feedback (open loop)
- Regulating rated motor speed within 1% without tachometer or encoder feedback, or within $\pm 0.02\%$ with an encoder feedback circuit (option card)

Each Type H drive controller has a selectable switching frequency that can be adjusted to match the application requirements. The switching frequency can be programmed to fold back in the event of excessive heat. The drive controller reverts back to the programmed choice upon reaching the normal thermal state.

In addition, each 15 hp (CT) to 50 hp (VT) 208/230 Vac Type H controller and each 25 hp (CT) to 100 hp (VT) 400/460 Vac Type H controller includes a line reactor integrated into the heatsink plenum. The line reactor improves reliability and reduces input currents to the drive controller.

Most ATV58 TRX drive controllers are available with an integrated EMC filter. This filter reduces conducted and radiated emissions, and complies with IEC product standards IEC 61800-3 and EN 61800-3 for drive controllers. Compliance with these standards meets the requirements of the European directive on EMC.

Configuration tools, operator interfaces, I/O extension options, and communication options are shared throughout the product range.



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ATV58 TRX Type H Product Family

The ATV58 TRX series of adjustable frequency AC drive controllers is a Transparent Ready™ product line providing extended functionality and an extended horsepower range for the ATV58 AC drive family. The ATV58 TRX series includes an analog output, expanded firmware capabilities, and a horsepower range up to 500 hp. As a Transparent Ready product equipped with an Ethernet communication card, the ATV58 TRX product line can be configured, controlled, monitored, and diagnosed over an Ethernet network with a standard Web browser. No special software or drivers are needed.

Altivar® 58 TRX AC Drives

Type H Drive Controllers

Ratings

ATV58 TRX Type H drive controllers may be rated for constant torque (CT), variable torque (VT), and variable torque low noise (VTLN) applications.

- CT applications usually require 100% of motor-rated torque through the entire speed range, high transient torque capability, and speed regulation.
- VT applications, such as centrifugal fans and centrifugal pumps, do not require high transient torque capability. This typically allows a drive to be rated for additional horsepower and additional current as compared to the constant torque rating.
- VTLN applications, such as centrifugal fans and centrifugal pumps, do not require high transient torque capability. However, this rating uses a higher switching frequency for quieter motor operation. As a result, the drive may be rated at the same horsepower and current as the constant torque rating, particularly at large horsepower sizes.

The 125–500 hp drive controllers are listed in this catalog with ratings typically used for VT applications. With proper selection, this range of controllers can also be used in CT applications, such as compressors, conveyors, and extruders, where high performance is not required at low speeds. The 125–500 hp product ratings in this catalog are for applications that require 100% rated torque down to 6 Hz. If the application requires more than 110% transient torque for one minute, select the appropriate horsepower product. For assistance with selecting the proper AC drive controller for constant torque applications, consult your local Square D drives specialist.

Application information is also available in product data bulletin SC100, *Adjustable Frequency Controllers Application Guide*, available at www.SquareD.com, or the NEMA Standards Publication: *Application Guide For AC Adjustable Speed Drive Systems*.

Ratings for ATV58 TRX Type H Constant Torque; 208/230 Vac, Single-Phase Input with 3-Phase Output; Switching Frequency at 4 kHz

Frame Size	Drive Controller Catalog Number ▼	Motor Power 208/230 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
1	ATV58HU09M2ZU	0.37	0.5	2.3	3.1	42
1	ATV58HU18M2ZU	0.75	1	4.1	5.6	64
2	ATV58HU29M2ZU	1.5	2	7.8	10.6	107
2	ATV58HU41M2ZU	2.2	3	11	15.0	156
3	ATV58HU72M2ZU ■	3	4	13.7	18.6	160
4	ATV58HU90M2ZU ■	4	5	18.2	24.8	176
4	ATV58HD12M2ZU ■	5.5	7.5	24.2	32.9	204

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

■ When these drive controllers are used with a single-phase input, a line reactor (3% minimum) must be used.

Ratings for ATV58 TRX Type H Variable Torque, Low Noise; 208/230 Vac, Single-Phase Input with 3-Phase Output; Switching Frequency: ATV58HU09M2–D12M2 at 8 kHz; ATV58HD16M2–D46M2 at 4 kHz

Frame Size	Drive Controller Catalog Number ▼	Motor Power 208/230 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
1	ATV58HU09M2ZU	0.37	0.5	2.5	2.8	42
1	ATV58HU18M2ZU	0.75	1	4.8	5.3	64
2	ATV58HU29M2ZU	1.5	2	7.8	8.6	107
2	ATV58HU41M2ZU	2.2	3	11	12.1	156
3	ATV58HU72M2ZU ■	3	4	14.3	15.7	160
4	ATV58HU90M2ZU ■	4	5	17.5	19.3	176
4	ATV58HD12M2ZU ■	5.5	7.5	25.3	27.8	204
6	ATV58HD16M2XZU ■	7.5	10	30.8	33.9	323
6	ATV58HD23M2XZU ■	11	15	46.2	50.8	550
7	ATV58HD28M2XZU ■	15	20	60	66.0	745
7	ATV58HD33M2XZU ■	18.5	25	75	82.5	895
7	ATV58HD46M2XZU ■	22	30	88	96.8	900

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

■ When these drive controllers are used with a single-phase input, a line reactor (3% minimum) must be used.

Altivar® 58 TRX AC Drives Type H Drive Controllers

Ratings for ATV58 TRX Type H Constant Torque
208/230 Vac, 3-Phase Input with 3-Phase Output
Switching Frequency: ATV58HU29M2–D23M2 at 4 kHz, ATV58HD28M2–D46M2 at 2 kHz

Frame Size	Drive Controller Catalog Number ▼	Motor Power 208/230 V		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU29M2ZU	1.5	2	7.8	10.6	107
2	ATV58HU41M2ZU	2.2	3	11	15	160
3	ATV58HU54M2ZU	3	4	13.7	18.6	190
3	ATV58HU72M2ZU	4	5	18.2	24.8	240
4	ATV58HU90M2ZU	5.5	7.5	24.2	32.9	255
4	ATV58HD12M2ZU	7.5	10	31	42.2	350
6	ATV58HD16M2XZU	11	15	47	63.9	745
6	ATV58HD23M2XZU	15	20	60	81.6	895
7	ATV58HD28M2XZU	18.5	25	75	102	900
7	ATV58HD33M2XZU	22	30	88	119.7	1030
7	ATV58HD46M2XZU	30	40	116	157.8	1315

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

Ratings for ATV58 TRX Type H Variable Torque
208/230 Vac, 3-Phase Input with 3-Phase Output
Switching Frequency: ATV58HU29M2–D23M2 at 4 kHz, ATV58HD28M2–D46M2 at 2 kHz

Frame Size	Drive Controller Catalog Number ▼	Motor Power 208/230 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU29M2ZU	1.5	2	7.5	8.3	107
2	ATV58HU41M2ZU	2.2	3	10.6	11.7	158
3	ATV58HU54M2ZU	3	4	14.3	15.7	190
3	ATV58HU72M2ZU	4	5	16.7	18.4	198
4	ATV58HU90M2ZU	5.5	7.5	24.2	26.6	235
4	ATV58HD12M2ZU	7.5	10	30.8	33.9	323
6	ATV58HD16M2XZU	11	15	46.2	50.1	550
6	ATV58HD16M2XZU	15	20	60	66	745
6	ATV58HD23M2XZU	18.5	25	75	82.5	895
7	ATV58HD28M2XZU	22	30	88	96.8	900
7	ATV58HD33M2XZU	30	40	116	127.6	1030
7	ATV58HD46M2XZU	37	50	143	157.3	1315

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

Ratings for ATV58 TRX Type H Variable Torque, Low Noise
208/230 Vac, 3-Phase Input with 3-Phase Output
Switching Frequency: ATV58HU29M2–D23M2 at 8 kHz, ATV58HD28M2–D46M2 at 4 kHz

Frame Size	Drive Controller Catalog Number ▼	Motor Power 208/230 V		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU29M2ZU	1.5	2	7.5	8.3	107
2	ATV58HU41M2ZU	2.2	3	10.6	11.7	158
3	ATV58HU54M2ZU	3	4	14.3	15.7	190
3	ATV58HU72M2ZU	4	5	16.7	18.4	198
4	ATV58HU90M2ZU	5.5	7.5	24.2	26.6	235
4	ATV58HD12M2ZU	7.5	10	30.8	33.9	323
6	ATV58HD16M2XZU	11	15	46.2	50.1	745
6	ATV58HD23M2XZU	15	20	60	66	890
7	ATV58HD28M2XZU	18.5	25	75	82.5	980
7	ATV58HD33M2XZU	22	30	88	96.8	975
7	ATV58HD46M2XZU	30	40	116	127.6	1215

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

Altivar® 58 TRX AC Drives

Type H Drive Controllers

Ratings for ATV58 TRX Type H Constant Torque
 400/460 Vac, 3-Phase Input with 3-Phase Output
 Switching Frequency: ATV58HU18N4–D46N4 at 4 kHz, ATV58HD54N4–D79N4 at 2 kHz

Frame Size	Drive Controller Catalog Number▼	Motor Power 400/460 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU18N4ZU	0.75	1	2.3	3.1	57
2	ATV58HU29N4ZU	1.5	2	4.1	5.6	97
2	ATV58HU41N4ZU	2.2	3	5.8	7.9	120
3	ATV58HU54N4XZU	3	4	7.8	10.6	170
3	ATV58HU72N4XZU	4	5	10.5	14.3	210
3	ATV58HU90N4XZU	5.5	7.5	13	17.7	295
4	ATV58HD12N4XZU	7.5	10	17.6	23.9	360
4	ATV58HD16N4XZU	11	15	24.2	32.9	480
5	ATV58HD23N4XZU	15	20	33	44.9	590
6	ATV58HD28N4XZU	18.5	25	40.7	55.4	421
6	ATV58HD33N4XZU	22	30	48.4	65.8	491
6	ATV58HD46N4XZU	30	40	66	89.8	625
7	ATV58HD54N4XZU	37	50	79.2	107.7	677
7	ATV58HD64N4XZU	45	60	93.5	127.2	837
7	ATV58HD79N4XZU	55	75	115.5	157.1	1090

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

Ratings for ATV58 TRX Type H Variable Torque, Low Noise
 400/460 Vac, 3-Phase Input with 3-Phase Output
 Switching Frequency: ATV58HU18N4–D46N4 at 8 kHz, ATV58HD54N4–D79N4 at 4 kHz

Frame Size	Drive Controller Catalog Number▼	Motor Power 400/460 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU18N4ZU	0.75	1	2.1	2.3	57
2	ATV58HU29N4ZU	1.5	2	3.4	3.7	97
2	ATV58HU41N4ZU	2.2	3	4.8	5.3	119
3	ATV58HU54N4XZU	—	5	7.6	8.4	209
3	ATV58HU72N4XZU	—	7.5	11	12.1	291
3	ATV58HU90N4XZU	—	10	14	15.4	352
4	ATV58HD12N4XZU	—	15	21	23.1	472
4	ATV58HD16N4XZU	—	20	27	29.7	584
5	ATV58HD23N4XZU	—	25	34	37.4	654
6	ATV58HD28N4XZU	18.5	25	34	37.4	502
6	ATV58HD33N4XZU	22	30	40	44	584
6	ATV58HD46N4XZU	30	40	52	57.2	714
7	ATV58HD54N4XZU	37	50	65	71.5	732
7	ATV58HD64N4XZU	45	60	77	84.7	904
7	ATV58HD79N4XZU	55	75	96	105.6	1183

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter. If an internal EMC filter is required, delete the "X" from the catalog number.

Altivar® 58 TRX AC Drives Type H Drive Controllers

**Ratings for ATV58 TRX Type H Variable Torque
400/460 Vac, 3-Phase Input with 3-Phase Output**

Switching Frequency: ATV58HU18N4–D23N4 at 8 kHz, ATV58HD28N4-D46N4 at 4 kHz, ATV58HD54N4–C33N4X at 2 kHz

Frame Size	Drive Controller Catalog Number▼	Motor Power 400/460 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58HU18N4ZU	0.75	1	2.1	2.3	57
2	ATV58HU29N4ZU	1.5	2	3.4	3.7	97
2	ATV58HU41N4ZU	2.2	3	4.8	5.3	119
3	ATV58HU54N4XZU	3	4	6.2	6.8	170
3	ATV58HU72N4XZU	4	5	7.6	8.4	209
3	ATV58HU90N4XZU	5.5	7.5	11	12.1	291
4	ATV58HD12N4XZU	7.5	10	14	15.4	352
4	ATV58HD16N4XZU	11	15	21	23.1	472
5	ATV58HD23N4XZU	15	20	27	29.7	584
6	ATV58HD28N4XZU■	18.5	25	34	37.4	474
6	ATV58HD28N4XZU	22	30	40	44	618
6	ATV58HD33N4XZU	30	40	52	57.2	713
6	ATV58HD46N4XZU	37	50	65	71.5	770
7	ATV58HD54N4XZU	45	60	77	84.7	987
7	ATV58HD64N4XZU	55	75	96	105.6	1075
7	ATV58HD79N4XZU	75	100	124	136.4	1439
8	ATV58HC10N4XZU	90	125	156	172	2250
9	ATV58HC13N4XZU	110	150	180	198	2750
9	ATV58HC15N4XZU	132	200	240	264	3300
9	ATV58HC19N4XZU	160	250	302	332	4000
10	ATV58HC23N4XZU	200	300	361	397	5000
10	ATV58HC25N4XZU	220	350	414	455	5500
10	ATV58HC28N4XZU	250	400	477	525	6250
10	ATV58HC31N4XZU	280	450	515	567	7000
10	ATV58HC33N4XZU	315	500	590	649	7875

▼ Refer to page 127 for a complete list of catalog numbers. An "X" in the catalog number indicates that the product does not have an internal EMC filter.

■ The ATV58HD28N4 is rated for 8 kHz operation at 25 hp.

Altivar® 58 TRX AC Drives Type E Drive Controllers



ATV58E1MAB, w/ no back-tilt

ATV58 TRX Type E Product Family

ATV58 TRX TYPE E DRIVE CONTROLLERS

The ATV58 TRX family of adjustable-frequency AC drive controllers is used to control three-phase asynchronous motors. The ATV58 TRX Type E model contains an ATV58 TRX Type H drive controller packaged in a compact, Type 1 enclosure. It is for use in mechanical rooms, OEM equipment, and factory floor applications. The following Type E drive controller models are available:

- 1 to 7½ hp (0.75 to 5.5 kW), 400/460 Vac, three-phase input
- ½ to 3 hp (0.37 to 2.2 kW), 200/240 Vac, single-phase input
- 2 to 3 hp (1.5 to 2.2 kW), 200/240 Vac, three-phase input

Each ATV58 TRX Type E drive controller contains:

- A GV2 manual motor starter, ATV58 TRX drive controller, and an output contactor
- A three-position selector switch wired for “RUN FORWARD”
- A manual speed potentiometer mounted on the front of the enclosure
- Space for two additional 16-mm operators
- Four conduit openings that are closed with plugs
- A transparent plastic door for viewing the status LEDs and a separately-supplied keypad

All ATV58 TRX communication and I/O options can be used in the Type E controllers. The Type E drive controllers can be used on constant or variable torque applications. The ratings are shown in the tables below.

200 Vac -10% / 240 Vac +10% at 50/60 Hz ±5%, Single-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
1	ATV58EU09M2ZU	0.37	0.5	2.3	3.1
1	ATV58EU18M2ZU	0.75	1	4.1	5.6
2	ATV58EU29M2ZU	1.5	2	7.8	10.6
3	ATV58EU41M2ZU [■]	2.2	3	11	15

200 Vac -10% / 240 Vac +10% at 50/60 Hz ±5%, 3-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
2	ATV58EU29M2ZU	1.5	2	7.8	10.6
3	ATV58EU41M2ZU	2.2	3	11	15

400 Vac -10% / 460 Vac +10% at 50/60 Hz ±5%, 3-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
2	ATV58EU18N4ZU	0.75	1	2.3	3.1
2	ATV58EU29N4ZU	1.5	2	4.1	5.6
2	ATV58EU41N4ZU	2.2	3	5.8	7.9
3	ATV58EU54N4ZU	3	–	7.8	10.6
3	ATV58EU72N4ZU	4	5	10.5	14.3
3	ATV58EU90N4ZU	5.5	7.5	13	17.7

[▲] For dimensions, see page 122; for wiring diagrams, see pages 109 and 110.

[▼] Power indicated is for a switching frequency between 0.5 and 4 kHz, and at steady state. For switching frequency between 8 and 16 kHz, use the next largest size drive controller. (For example, for 2 hp, order drive controller ATV58EU41M2ZU.) If the duty cycle (that is, the drive controller run time) does not exceed 60% (36 second maximum for a 60 second cycle), this is not necessary.

[◆] For 60 seconds.

[■] A line reactor (3% minimum) must be used with this drive controller.

Altivar® 58 TRX AC Drives Type F Drive Controllers

ATV58 TRX TYPE F DRIVE CONTROLLERS



ATV58NEM1A8_w no back.tif

ATV58 TRX Type F Product Family

The ATV58 TRX family of adjustable-frequency AC drive controllers is used to control three-phase asynchronous motors. ATV58 TRX Type F models contain an ATV58 TRX Type H drive controller packaged in a compact Type 12 enclosure. They are for use in mechanical rooms, OEM equipment, and factory floor applications requiring a local load break switch and input line fusing. The following models are available:

- 1 to 7.5 hp (0.75 to 5.5 kW), 400/460 Vac, three-phase input
- ½ to 3 hp (0.37 to 2.2 kW), 200/240 Vac, single-phase input
- 2 to 3 hp (1.5 to 2.2 kW), 200/240 Vac, three-phase input

Each ATV58 TRX Type F drive controller contains:

- A Vario load break switch, input line fuses, and an ATV58 TRX drive controller
- Start Stop push buttons
- A manual speed potentiometer mounted on the front of the enclosure
- Space for one additional 16-mm operator
- Four conduit openings that are closed with plugs
- A transparent plastic door to allow viewing of status LEDs and a separately supplied keypad

All ATV58 TRX communications and I/O options can be used in the Type F drive controllers. The Type F drive controllers can be used on constant or variable torque applications. The ratings are shown in the tables below.

200 Vac -10% / 240 Vac +10% at 50/60 Hz ±5%, Single-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current A	Transient Output Current [◆] A
		kW	HP		
1	ATV58EU09M2FZU	0.37	0.5	2.3	3.1
1	ATV58EU18M2FZU	0.75	1	4.1	5.6
2	ATV58EU29M2FZU	1.5	2	7.8	10.6
3	ATV58EU41M2FZU [■]	2.2	3	11	15

200 Vac -10% / 240 Vac +10% at 50/60 Hz ±5%, 3-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current A	Transient Output Current [◆] A
		kW	HP		
2	ATV58EU29M2FZU	1.5	2	7.8	10.6
3	ATV58EU41M2FZU	2.2	3	11	15

400 Vac -10% / 460 Vac +10% at 50/60 Hz ±5%, 3-Phase Input with 3-Phase Output

Frame Size [▲]	Drive Controller Catalog Number	Motor Power [▼]		Rated Output Current A	Transient Output Current [◆] A
		kW	HP		
2	ATV58EU18N4FZU	0.75	1	2.3	3.1
2	ATV58EU29N4FZU	1.5	2	4.1	5.6
2	ATV58EU41N4FZU	2.2	3	5.8	7.9
3	ATV58EU54N4FZU	3	–	7.8	10.6
3	ATV58EU72N4FZU	4	5	10.5	14.3
3	ATV58EU90N4FZU	5.5	7.5	13	17.7

[▲] For dimensions, see page 122; for wiring diagrams, see pages 111 and 112.

[▼] Power indicated is for a switching frequency between 0.5 and 4 kHz, and at steady state. For switching frequency between 8 and 16 kHz, use the next largest size drive controller. (For example, for 2 hp, order drive controller ATV58EU41M2FZU.) If the duty cycle (that is, the drive controller run time) does not exceed 60% (36 second maximum for a 60 second cycle), this is not necessary.

[◆] For 60 seconds.

[■] A line reactor (3% minimum) must be used with this drive controller.

Altivar® 58 TRX AC Drives Type N Drive Controllers



ATV58NEM420...w no backlit

ATV58 TRX Type N Product Family

ATV58 TRX TYPE N DRIVE CONTROLLERS

The ATV58 TRX family of adjustable-frequency AC drive controllers is used to control three-phase asynchronous motors. The ATV58 TRX Type N models contain an ATV58 TRX Type H drive controller packaged in a Type 4/4x stainless steel enclosure. They are for use in food and beverage wash-down applications. The Type N drive controller was tested for corrosion resistance per UL-50 and exceeds this standard. The UL-50 corrosion test was conducted using ASTM B117-1985.

The following models are available:

- 1 to 10 hp (0.75 to 7.5 kW), 400/460 Vac, 3-phase input.
- ½ to 3 hp (0.37 to 2.2 kW), 208/230 Vac, single-phase input.
- ½ to 5 hp (0.37 to 4.0 kW), 208/230 Vac, 3-phase input.

Each Type N drive controller is furnished with four conduit openings that are closed with Type 4/4x plugs. The drive is available with a keypad mounted behind a transparent boot to allow viewing and operation of the keypad while maintaining the Type 4/4x rating. If a keypad is not required, a closing plate can be installed to maintain the Type 4/4x rating. All ATV58 TRX communication and I/O options can be used in the Type N controllers. The Type N drive controllers can be used on constant or variable torque applications. The ratings are shown in the tables below.

208 to 230 Vac, Single-Phase Input with 3-Phase Output

Frame Size	Drive Controller Catalog Number [▲]	Motor Power*		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
1	ATV58NU09M2•	0.37	0.5	2.3	3.1
1	ATV58NU18M2•	0.75	1	4.1	5.6
2	ATV58NU29M2•	1.5	2	7.8	10.6
2	ATV58NU41M2•■	2.2	3	11	15

208 to 230 Vac, 3-Phase Input with 3-Phase Output

Frame Size	Drive Controller Catalog Number [▲]	Motor Power*		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
2	ATV58NU29M2•	1.5	2	7.8	10.6
2	ATV58NU41M2•	2.2	3	11	15
3	ATV58NU54M2•	3	–	13.7	18.6
3	ATV58NU72M2•	4	5	18.2	24.7

400 to 460 Vac, 3-Phase Input with 3-Phase Output

Frame Size	Drive Controller Catalog Number [▲]	Motor Power*		Rated Output Current	Transient Output Current [◆]
		kW	HP	A	A
2	ATV58NU18N4•	0.75	1	2.3	3.1
2	ATV58NU29N4•	1.5	2	4.1	5.6
2	ATV58NU41N4•	2.2	3	5.8	7.9
3	ATV58NU54N4•	3	–	7.8	10.6
3	ATV58NU72N4•	4	5	10.5	14.3
3	ATV58NU90N4•	5.5	7.5	13	17.7
4	ATV58ND12N4•	7.5	10	17.6	24

▲ Complete the catalog number by entering KU for ATV58 Type N drive controllers with factory-installed keypad, or ZU for controllers without a factory-installed keypad. For dimensions, see page 122; for wiring diagrams, see page 108.

* Power indicated is for a switching frequency between 0.5 and 4 kHz, and at steady state. For switching frequency between 8 and 16 kHz, derate the drive controller by one horsepower size (for example, for ½ hp, order drive controller ATV58NU18M2). If the duty cycle (i.e., drive controller run time) does not exceed 60% (36 second maximum for a 60 second cycle), derating is not required for operation above 8 kHz.

◆ For 60 seconds.

■ When these drive controllers are used with a single-phase input, a line reactor (3% minimum) must be used.

ATV58 TYPE FVC DRIVE CONTROLLERS

Features

The ATV58 Type FVC family of adjustable frequency AC drive controllers are used for controlling three-phase asynchronous motors ranging from 1 to 75 hp (constant torque), 400/460 Vac, 3-phase input.

The ATV58 TRX operator interfaces, configuration tools, I/O extension options, and communication options are shared throughout the product range, except the general purpose option card which is not for use with the ATV58 Type FVC controllers.

The ATV58 Type FVC drive controller uses the latest in AC drive technology. Intelligent Power Modules (IPMs) are used on the entire product family. The IPMs contain insulated gate bipolar transistors (IGBTs) to produce a pulse width modulated (PWM) output waveform to the motor. IPMs minimize part count and improve reliability.

The ATV58 Type FVC drive controller integrates fourth-generation sensorless flux vector control for 3-phase asynchronous squirrel cage AC motors. This allows the drive controller to deliver needed torque with excellent dynamic response over a wide speed range.

ATV58 Type FVC drive controllers are capable of:

- Producing transient torque of 200% (typical value $\pm 10\%$) of nominal motor torque for 2 seconds
- Producing transient torque of 170% (typical value $\pm 10\%$) of nominal motor torque for 60 seconds
- Producing 160% of rated motor torque at 0 Hz with encoder feedback (closed loop) or at 0.5 Hz without tachometer or encoder feedback (open loop)
- Regulating rated motor speed within 1% without tachometer or encoder feedback or within $\pm 0.01\%$ with an encoder feedback circuit

Every Type FVC drive controller has selectable switching frequency that can be adjusted to match the application needs. The switching frequency can be programmed to fold-back in the event of excessive heat. The drive controller reverts back to the programmed choice upon reaching the normal thermal state.

In addition, each 25 hp to 75 hp 400/460 Vac drive controller includes a line reactor integrated into the heatsink plenum. This line reactor improves product reliability and reduces input currents to the drive controller.

Every ATV58 Type FVC drive controller is supplied with an integrated EMC filter. This filter reduces conducted and radiated emissions, and complies with IEC product standards IEC 61800-3 and EN 61800-3 for drive controllers. Compliance with these standards meets the requirements of the European directive on EMC.



ATV58 Type FVC Product Family

The ATV58 Type FVC series of adjustable frequency AC drive controllers is a Transparent Ready™ product line providing extended functionality. The ATV58 Type FVC series includes an analog output, expanded firmware capabilities, and a horsepower range up to 75 hp. As a Transparent Ready product equipped with an Ethernet communication card, the ATV58 Type FVC product line can be configured, controlled, monitored, and diagnosed over an Ethernet network with a standard Web browser. No special software or drivers are needed.

Altivar® 58 TRX AC Drives Type FVC Drive Controllers

Applications

The ATV58 Type FVC product is recommended in place of the ATV58 TRX Type H drive controllers in the following applications:

- Applications that require encoder feedback and the installation of an I/O extension card or a communication card
- Applications that require PID regulation of a process loop
- Applications requiring improved open loop torque performance at low speed
- Applications requiring high torque performance at low speed with encoder feedback
- Applications requiring holding torque at zero speed

The ATV58 Type FVC product has the following hardware not supplied with the ATV58 TRX Type H base product:

- Differential analog input, +/- 10 Vdc (+10 Vdc supplied from drive)
- RS422 encoder input, 5 V (max. frequency input: 200 kHz)
- Encoder power supply (5 V, 200 mA)
- A keypad is supplied with the drive controller

The ATV58 Type FVC product has the following software features not supplied with the ATV58 TRX Type H base product:

- Faster motor control algorithm in open loop and closed loop
- PID regulator with trim input
- Motor pre-fluxing options; continuous or by logic input
- Ability to customize the shape of the acceleration and deceleration ramps. Selectable acceleration and deceleration ramp increments are 0.1seconds or 0.01 seconds.
- Ability to use +/- speed trim around a speed reference input
- PI and IP mode of operation for matching initial response time vs.ability to suppress speed overshoot
- Variable torque macro has been removed. No variable torque ratings.

The ATV58 Type FVC drive controller is rated for Constant Torque (CT) applications. Constant Torque applications usually require motor-rated torque through the entire speed range, high transient torque capability, and precise speed regulation.

Altivar® 58 TRX AC Drives Type FVC Drive Controllers

Ratings

Ratings for ATV58 Type FVC Constant Torque
400 /460 Vac, 3-Phase Input with 3-Phase Output
Switching Frequency: ATV58FHU18N4–D46N4 at 4 kHz, ATV58FHD54N4–D79N4 at 2 kHz

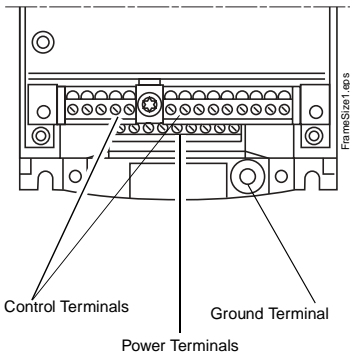
Frame Size	Drive Controller Catalog Number	Motor Power 400/460 Vac		Rated Output Current	Transient Output Current	Total Dissipated Power at Rated Load
		kW	HP	A	A	W
2	ATV58FHU18N4KU	0.75	1	2.3	3.1	57
2	ATV58FHU29N4KU	1.5	2	4.1	5.6	97
2	ATV58FHU41N4KU	2.2	3	5.8	7.9	120
3	ATV58FHU54N4KU	3	4	7.8	10.6	170
3	ATV58FHU72N4KU	4	5	10.5	14.3	210
3	ATV58FHU90N4KU	5.5	7.5	13	17.7	295
4	ATV58FHD12N4KU	7.5	10	17.6	23.9	360
4	ATV58FHD16N4KU	11	15	24.2	32.9	480
5	ATV58FHD23N4KU	15	20	33	44.9	590
6	ATV58FHD28N4KU	18.5	25	40.7	55.4	421
6	ATV58FHD33N4KU	22	30	48.4	65.8	491
6	ATV58FHD46N4KU	30	40	66	89.8	625
7	ATV58FHD54N4KU	37	50	79.2	107.7	677
7	ATV58FHD64N4KU	45	60	93.5	127.2	837
7	ATV58FHD79N4KU	55	75	115.5	157.1	1090

Altivar® 58 TRX AC Drives

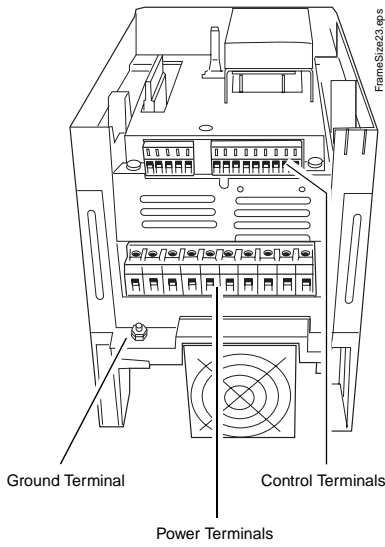
Terminal Locations for Type H and Type FVC Drives

TERMINAL LOCATIONS FOR ATV58 TRX TYPE H AND TYPE FVC DRIVES

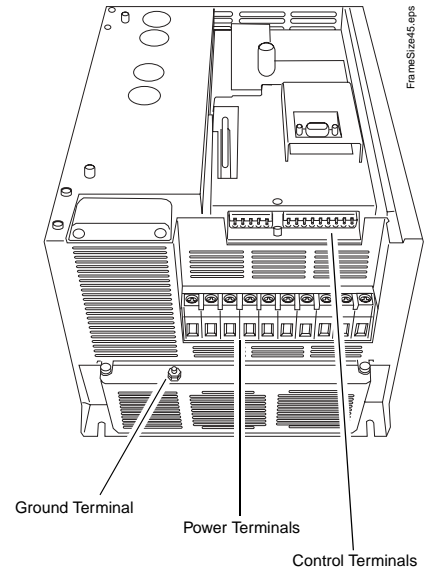
NOTE: These illustrations show the locations of the major terminal groups.



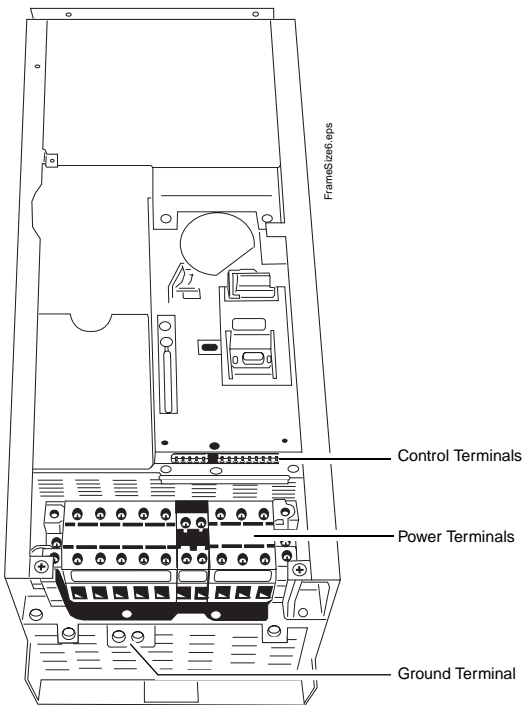
Frame Size 1



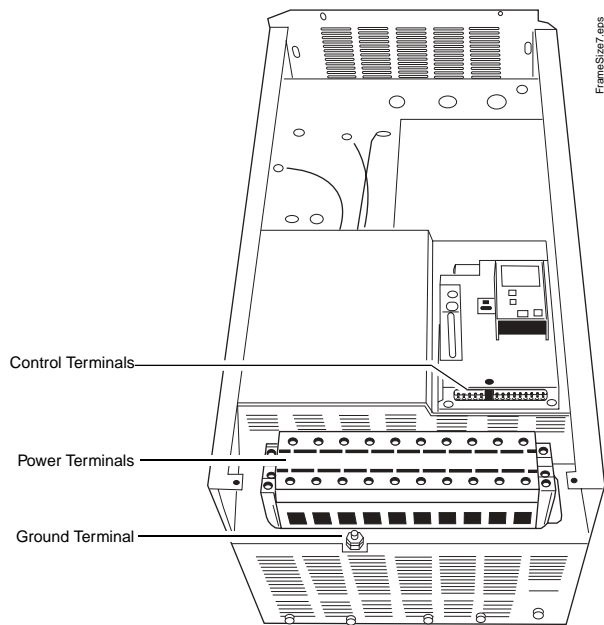
Frame Sizes 2 and 3



Frame Sizes 4 and 5



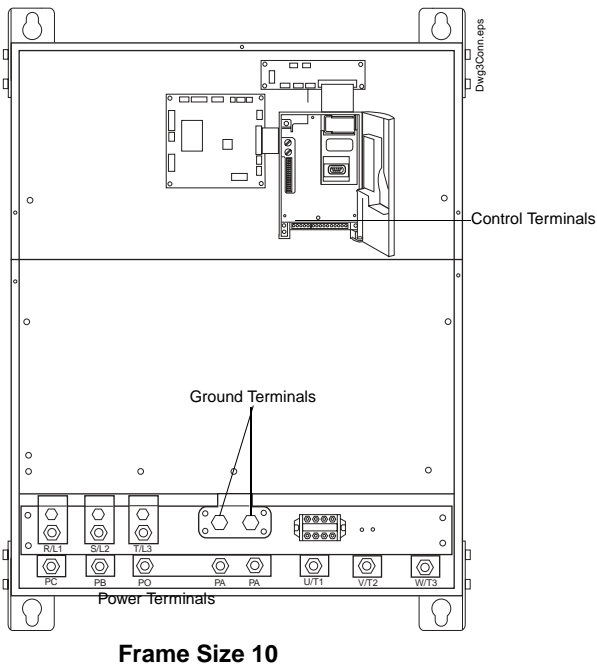
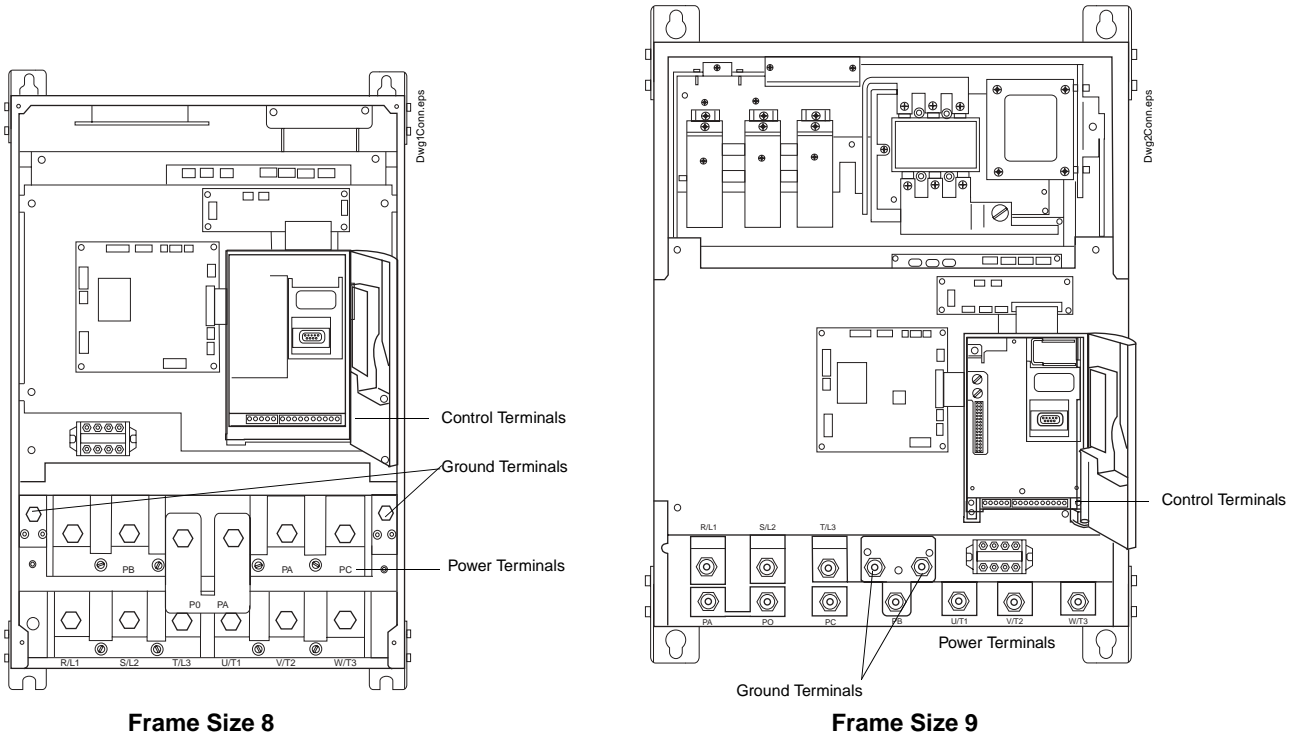
Frame Size 6



Frame Size 7

Altivar® 58 TRX AC Drives Terminal Locations for Type H and Type FVC Drives

TERMINAL LOCATIONS FOR ATV58 TRX TYPE H DRIVES



Altivar® 58 TRX AC Drives

Description of Power Terminals

DESCRIPTION OF POWER TERMINALS

As shown in the drawing to the left, the ATV58 TRX power terminal arrangements differ from model to model. The locations of the power terminals are shown on pages 18–19. The following tables describe the characteristics of the power terminals and list maximum wire sizes and tightening torques for the various ATV58 TRX models.

ATV58*U09M2 - U18M2

⏚	L1	L2	+	-	U	V	W	⏚
---	----	----	---	---	---	---	---	---

ATV58*U29M2 - D12M2
ATV58*U18N4 - D23N4

⏚	L1	L2	L3	PA	PB	U	V	W	⏚
---	----	----	----	----	----	---	---	---	---

ATV58*D16M2 - D46M2
ATV58*U28N4 - D79N4

⏚	L1	L2	L3	+	-	PA	PB	U	V	W	⏚
---	----	----	----	---	---	----	----	---	---	---	---

ATV58HC10N4X

⏚				PA	PC	⏚
	L1	L2	L3	U	V	W

ATV58HC13N4X–C19N4X

L1	L2	L3	⏚	⏚	
PA	PC				
(+)	(-)				
			U	V	W

ATV58HC23N4X–C33N4X

L1	L2	L3	⏚	⏚	
PC			PA	PA	
(-)			(+)		
			U	V	W

ATV58Exxxxxx

1	2	3	4	5	6	7	8
⏚	U	V	W	K13	K14	PA	PB

J2A

4	3	2	1
L3	L2	L1	⏚

ATV58EU09M2ZU and ATV58EU18M2ZU
(single-phase input only)

J2B

1	2	3	4	5	6	7	8
⏚	U	V	W	K13	K14	+	-

J2A

*	3	2	1
L3	L2	L1	⏚

* L3 is not used

ATV58 TRX Power Terminals

Power Terminals

Function of Power Terminals

Terminal	Function	Found On
⏚	Ground terminal (2 provided on some models).	All ATV58 TRX models.
L1 L2	Input power.	All models.
L3		All models except U09M2* and U18M2*.
+	Connection for DB module.	Models U09M2* and U18M2*.
-		
PA PB	Connection for DB resistor.	All models except U09M2*, U18M2*, and C10N4–C33N4.
U V W	Output connections to motor.	All models.
K13 K14	N.O. auxiliary contact on controller's output contactor. Maximum rating is 10 A at 600 Vac.	ATV58EU09M2ZU – U90N4FZ4.

Power Terminal Wire Size and Torque

Type FVC, Type H, and Type N Models	Maximum Wire Size* AWG (mm ²)	Torque lb-in (N•m)
U09M2, U18M2	14 (1.5)	5.0 (0.55)
U29M2, U41M2, U18N4, U29N4, U41N4	8 (6)	7.5 (0.85)
U54M2, U72M2, U54N4, U72N4, U90N4	8 (6)	7.5 (0.85)
U90M2, D12M2, D12N4, D16N4, D23N4	6 (10)	20 (2.25)
D16M2, D23M2, D28N4, D33N4, D46N4	2/0 (35)	88 (10)
D28M2, D33M2, D46M2, D54N4, D64N4, D79N4	4/0 (70)	170 (19)
C10N4X–C19N4X	500 MCM	375 (42)
C23N4X–C33N4X	Supply crimp style lugs to fit selected wire size.	
Type E and Type F Models		
All models	10 (4)	5.0 (0.55)

* 75 °C copper.

CONDUIT CONNECTIONS FOR TYPE E AND TYPE F DRIVE CONTROLLERS

The ATV58 TRX Type E and Type F drive controllers are furnished with four conduit openings at the bottom of the device. The conduit openings are closed with Type 1 rated plugs. The holes are intended for input and output power wiring, control wiring, and connection to external components such as DB resistors or line reactors. To maintain the enclosure rating, do not remove the plugs from unused conduit holes. Conduit holes are pre-drilled for the conduit listed in the table below.

Type E and Type F Models	Conduit Hole Size	Conduit Size	Hub Catalog No.
ATV58EU09M2ZU ATV58EU18M2ZU	7/8 inch	1/2 inch	25211-16102
All other ATV58 Type E and Type F Drive Controllers	1 and 3/32 inch	3/4 inch	25211-24102

Flexible conduit must be used up to the drive controller to facilitate removal of the terminal block cover. A minimum of 2 feet is recommended.

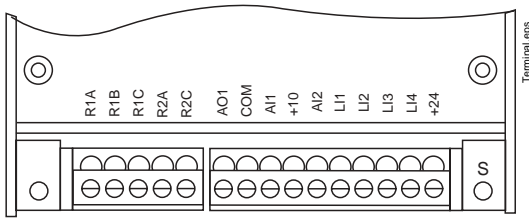
Altivar® 58 TRX AC Drives

Description of Control Terminals

DESCRIPTION OF CONTROL TERMINALS

All ATV58 TRX Type E, Type F, Type H, and Type N models have the same control terminals, shown in the figure to the left. The locations of the control terminals varies from model to model as shown on pages 18 and 19.

The control terminal strip contains two pull-apart terminal blocks, one for the relay outputs and one for the low-level inputs and outputs. The S terminal is used for the shield connection. Maximum wire size for all control terminals is 14 AWG (1.5 mm²). Tightening torque is 3.5 lb-in (0.4 N•m). The characteristics of the control terminals are shown in the table below.



ATV58 TRX Control Terminals

Terminal	Function	Characteristics
R1A R1B R1C	R1A to R1C is a N.O. contact. When the drive controller is powered with no fault, the contact is closed. R1B to R1C is a N.C. contact. When the drive controller is powered with no fault, the contact is open.	Min.: 10 mA, 24 Vdc Max. inductive load: 1.5 A for 250 Vac and 30 Vdc Max. resistive load: 5 A for 250 Vac or 30 Vdc
R2A R2C	N.O. programmable relay R2	
S	Shield connection	
COM	Common for logic and analog inputs	
AO1	Analog current output X–Y mA analog output, with X and Y programmable from 0–20 mA. Factory setting: 0–20 mA.	Maximum load impedance = 500 Ω Resolution: 0.04 mA (9 bits) Linearity: +/- 0.1 mA Accuracy: +/- 0.2 mA The analog output is updated every 2 mS, maximum.
AI1	Analog input 1 (voltage) Used for speed reference input	0 to 10 Vdc, Impedance = 30 kΩ Frequency resolution analog reference: (high speed/1024) Hz (10 bit) Accuracy ±1%, linearity ±0.5% of the maximum output frequency Sampling time: 5 ms Optically isolated
+10	Supply for reference potentiometer (1 to 10 kΩ)	10 V ± 1%, protected against short circuits and overloads 10 mA maximum
AI2	Programmable analog input Used for speed reference input or feedback, depending on configuration.	X to Y mA, with X and Y being programmable from 0 to 20 mA (factory setting: 0 to 20 mA) Impedance = 100 Ω Frequency resolution analog reference: (high speed/1024) Hz (10 bit) Accuracy ±1%, linearity ±0.5% of the maximum output frequency Sampling time: 5 ms Optically isolated
LI1 LI2 LI3 LI4	Programmable logic inputs Function depends on configuration.	Supplied by +24 Vdc State 0 if < 5 V, state 1 if > 11 V Vmax = 30 V Impedance = 3.5 kΩ Sampling time: 5 ms Optically isolated
+24	Power supply for logic inputs	+24 V protected against short circuits and overloads Minimum 20 V, maximum 30 V 200 mA maximum

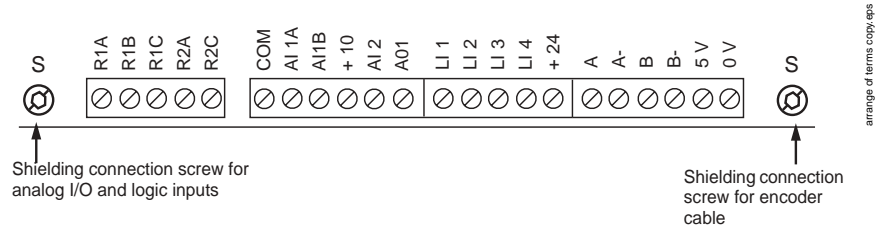
Altivar® 58 TRX AC Drives

Description of Type FVC Control Terminals

DESCRIPTION OF ATV58 TYPE FVC CONTROL TERMINALS

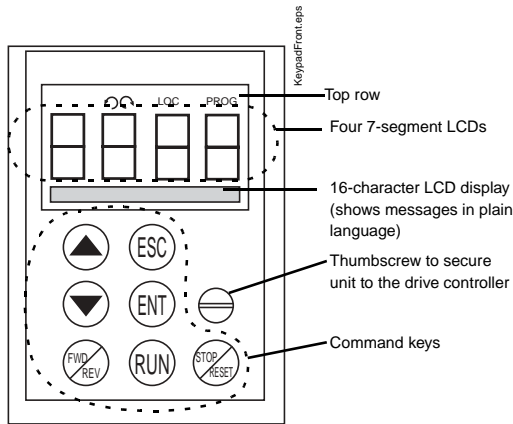
The ATV58 Type FVC control terminals are shown below. The location of the control terminal strip varies from model to model. See page 18.

The control terminal strip contains four pull-apart terminal blocks, one for the relay outputs and three for the low-level inputs and outputs. The S terminals are used to connect shield wires of multi-conductor control cables for the low level inputs, outputs, and encoder. Maximum wire size for all control terminals is 16 AWG (1.5 mm²). Tightening torque is 2.2 lb-in (0.25 N•m). The characteristics of the control terminals are shown in the table below.



Function of Terminals

Terminals	Function	Electrical Characteristics
R1A R1B R1C	R1A to R1C is a N.O. contact. When the drive controller is powered with no fault, the contact is closed. R1B to R1C is a N.C. contact. When the drive controller is powered with no fault, the contact is open.	<ul style="list-style-type: none"> Minimum switching capacity: 10mA for 24 Vdc. Maximum switching capacity on inductive load: 1.5 A for 250 V Vac (cos φ 0.4) and 30 Vdc (L/R 7 ms). Maximum response time: 20 ms.
R2A R2C	N.O. contact of R2 programmable relay	
COM	Common for logic and analog inputs	
AI1A AI1B	Differential analog input	<ul style="list-style-type: none"> ± 10V, impedance 40 kΩ in differential mode, 20 kΩ in common mode. Maximum permissible voltage ± 30 V. Resolution 11 bits + sign. Accuracy ± 0.5% of maximum value. Linearity ± 0.2% of maximum value. Sampling time 2 ms maximum.
+ 10	Supply for reference potentiometer (1 to 10 kΩ)	<ul style="list-style-type: none"> Voltage + 10 V (-0 + 10%) 10 mA maximum protected against short circuits and overloads.
AI2	Programmable analog input	<ul style="list-style-type: none"> Input 0-20 mA, programmable for X-Y mA by configuring X and Y (0 to 20). Impedance 100 Ω. Maximum permissible current 50 mA. Resolution 0.02 mA. Accuracy ± 1% of maximum value. Linearity ± 5% of maximum value. Sampling time 2 ms maximum.
AO1	Programmable analog output	<ul style="list-style-type: none"> Output 0-20 mA, programmable for X-Y mA by configuring X and Y (0 to 20). Load impedance 500 Ω maximum. Resolution 0.02 mA. Accuracy ± 1% of maximum value. Linearity ± 5% of maximum value. Sampling time 2 ms maximum.
LI1 LI2 LI3 LI4	Programmable logic inputs function depends on configuration	<ul style="list-style-type: none"> Impedance 3.5 kΩ. Power supply + 24 V (maximum 30 V). State 0 if < 5 V, state 1 if > 11V. Sampling time 2 ms maximum.
+ 24	Power supply for logic inputs	<ul style="list-style-type: none"> Voltage + 24 V protected against short circuits and overload, minimum 18 V, maximum 30 V. Maximum current 120 mA.
A A- B B-	Encoder inputs	<ul style="list-style-type: none"> For Incremental optical encoder with RS422-compatible differential outputs. Impedance 330 Ω. Maximum 5000 pulses/rev., minimum 100 pulses/rev. Maximum frequency 200 kHz at high speed (HSP).
+ 5 V 0 V	Power supply for encoder	<ul style="list-style-type: none"> Voltage 5 V (maximum 5.5 V) protected against short circuits and overloads. Maximum current 200 mA.



The Front of the Keypad Display Showing the LCDs and Command Keys

KEYPAD DISPLAY

The backlit keypad display is shown to the left.

- The four 7-segment LCDs display codes, parameter values, and run-time data. They are readable from a distance of three feet.
- The 16-character LCD display defines in plain language the name of the parameter being viewed, adjusted, assigned, or configured. This line also describes fault messages.
- The top row provides the following status information:



When flashing, this indicates the commanded direction of motor rotation. When steady, it indicates the actual direction of motor rotation.

LOC This indicates when the drive controller is in keypad command mode.

PROG This appears when the access control switch (located on the rear of the unit, see the figure to the lower left) is in partial lock position or total unlock position when "PROG" is flashing, a parameter was modified but not yet saved.

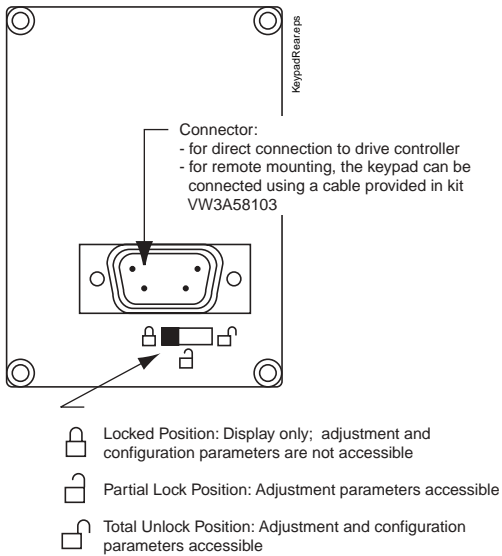
The functions of the keys are explained below:

- ▲ ▼ Press to move within menus or among the parameters, or to adjust a displayed value up or down.
- ESC Press to return to the previous menu, or abandon an adjustment in progress and return to the original value.
- ENT Press to select a menu, or validate and save a choice or adjustment.

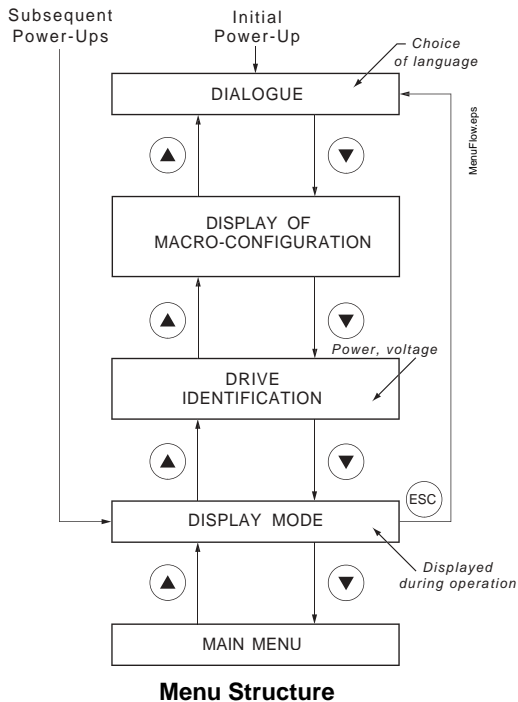
If command by the keypad is selected, the following keys are active:

- FWD/REV Press to change direction of motor rotation.
- RUN Press to start the motor.
- STOP/RESET Press to stop the motor or reset a fault. The STOP key can also stop the drive controller in terminal block command mode.

Altivar® 58 TRX AC Drives Keypad Display



The Back of the Keypad Display Showing the Access Control Switch and Connector



Configuration File Storage

The keypad can store four configuration files. This is useful for configuring multiple drives and verifying configurations.

Access Control

On the back of the keypad display is a three-position, access control switch and a connector (see the figure to the left). Access may also be controlled by using an access code.

The switch setting can deter unwanted tampering with adjustment and/or configuration parameters. PROG is displayed in the upper right-hand corner of the display when the switch is in partial lock position or total unlock position.

The following section describes the operations allowed for the various access control switch settings.

Accessing Menus

When a keypad display is the user interface, access is controlled by the three-position switch on the back of the keypad.

- With the switch in the locked position, the user can:
 - Select the dialog language
 - Display the macro-configuration
 - Identify the ATV58 TRX drive controller
 - Display the state of the controller, the electrical values, and the fault register
- With the switch in the partially locked position, the user can:
 - Perform the operations possible when the switch is in locked position
 - Modify settings
- With the switch in the total unlock position, the user can:
 - Perform the operations possible when the switch is in locked or partial locked positions
 - Change the macro-configuration
 - Modify the motor power
 - Modify all configuration parameters
 - Enable control via the keypad display buttons
 - Store, load, or protect the parameter files

When a PC is the user interface, no access restrictions exist unless an access code is configured (in which case, the access code must be entered to perform any actions.)

Altivar® 58 TRX AC Drives PowerSuite™ Software Option and Magelis® Terminal



POWERSUITE OPTION

PowerSuite software is a Windows®-based program providing an intuitive, graphical user interface for the Altivar 11, Altivar 28, and Altivar 58 TRX drive controllers, and Altistart® 48 softstart controllers. The software is designed to run on:

- Any PC using the Microsoft® Windows 95, Windows 98, Windows NT®, or Windows XP® operating system
- HP® Jornada® 520 or 540 series Pocket PC (PPC) using the Windows CE V3.0 operating system
- HP Jornada 560 series PPC or Compaq® iPAQ™ 3800 and 3900 series PPC, using the Windows CE V3.0 2002 operating system. PowerSuite V1.5 or later is needed for iPAQ PPCs.

The PowerSuite commissioning software allows you to:

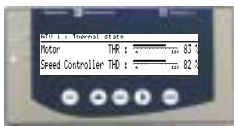
- Create, modify, and store controller configurations
- Transfer data to and from the controller
- Print a hard copy of the controller configuration for reference

In addition, for ATV28, ATV58, and ATS48 controllers:

- Operate the controller to verify proper commissioning
- Display and view run time data
- Display and view faults and fault history

When using the PC software, no access restrictions exist unless an access code has been configured.

MAGELIS TERMINAL



The Magelis terminal offers a unique solution for upgrading the user interface to one drive or multiple drives. The Magelis terminal can be used to connect up to 8 drive controllers via a Modbus RS-485 multi-drop link. The Magelis terminal can be used with ATV28 and ATV58 TRX drive controllers. The display is 240 x 64 pixel monochrome matrix backlit display.

The Magelis terminal has a factory loaded HMI application. This is easily modified with the XBT-L1003 software package to customize and configure the display. The terminal can be used to monitor, make adjustments to, and diagnose the drive controller. Drive status, operating parameters, and I/O status can be viewed.

The terminal requires a 24 Vdc power supply. A cable, (XBTZ908) is included for connection to a TSXSCA62 tap. The ATV58 TRX drive can be connected to the tap with the RS-485 Connection Kit (VW3A58306U) cable.

Altivar® 58 TRX AC Drives

Summary of User Interface Options and I/O Extension Cards

SUMMARY OF USER INTERFACE OPTIONS

The following table lists the various user interface options and provides a catalog number for ordering.

User Interface Option	Description	Catalog Number
Keypad Display	This plug-in terminal is inserted into a slot on the front panel of the ATV58 TRX controller.	VW3A58101U
Kit for Remote Location of Keypad Display	This kit may be used to locate the keypad display remotely (for example, on the door of the enclosure). The kit includes a 3-meter (9.8 foot) cable with connectors; a translucent protective cover for the keypad; and seals and screws for IP65 mounting on an enclosure door.	VW3A58103
PowerSuite Software	PowerSuite commissioning software on CD	VW3A8104
PC Connection Kit	Includes the following to connect a PC to an ATV11, ATV28, ATV58, or ATS48 controller: <ul style="list-style-type: none"> • 1 m cable with RJ45 connectors • RS-232 to RS-485 adapter with RJ45 and DB9 female connectors • RJ45 to DB9 adapter for use with an ATV58 controller • Cable adapter for use with an ATV11 controller, VW3A11301 	VW3A8106
PPC Connection Kit	Includes the following to connect a Jornada or iPAQ PPC to an ATV11, ATV28, ATV58, or ATS48 controller: <ul style="list-style-type: none"> • 1/2 m cable with RJ45 connectors • RS-232 to RS-485 adapter with RJ45 and DB9 female connectors • RJ45 to DB9 adapter for use with an ATV58 controller • Cable adapter for use with an ATV11 controller, VW3A11301 	VW3A8111
RS-485 Connection Kit	This kit allows RS-485 multidrop serial link connection to PLCs, man-machine terminals. It is connected in place of the keypad display, and therefore prevents the use of the keypad display at the same time that the ATV58 TRX controller is connected to PLCs. The kit includes a 3-meter (9.8 foot) cable with one male 9-pin SUB-D connector and one male 15-pin SUB-D connector; and a manual.	VW3A58306U
Magelis Terminal	This option is used with RS-485 connection kit. A cable, XBT2908 is included in the kit.	XBTHM017010A8

I/O EXTENSION CARDS

Overview of I/O Extension Cards

The ATV58 TRX controller can be specially adapted for certain applications by installing an I/O extension card. One I/O extension card can be mounted into the ATV58 TRX drive controller. Space is already provided in the controller for the card; no retrofitting or additional panel space is required. Three models are available:

- I/O Extension Card with Analog Input (VW3A58201U).
- I/O Extension Card with Encoder Inputs (VW3A58202U).
- Pump Switching Option Card (VW3A58210U).

If these I/O extension cards do not meet your needs, Schneider Electric can design and supply customer-specific I/O extension cards, incorporating both hardware functions (I/O) and software functions.

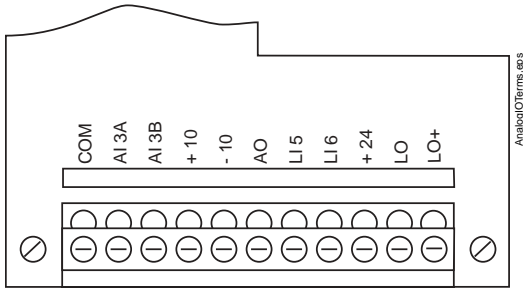
A 115 Vac logic input module (VW3A58275U) is available for applications requiring 115 Vac control circuits.

The following sections describe the I/O options in greater detail.



I/O_cards.tif

I/O Extension Cards



Terminals for the I/O Extension Card with Analog Inputs

I/O Extension Card with Analog Inputs (VW3A58201U)

This model includes two 24 Vdc logic inputs, one 24 Vdc open collector logic output, one 0 to 20 mA X-Y configurable analog output, and one bipolar ± 10 Vac analog input. The analog input may be used for speed correction with a tachogenerator, for feedback of the PI function, for processing of PTC motor protection probes, or for summing the frequency reference.

The figure to the left shows the location of the terminals for this I/O card. The following tables describe the terminal functions and characteristics. See page 50 for a summary of configurable I/O functions.

Functions and Characteristics of Terminals

Terminal	Function	Characteristics
COM	Common for analog inputs and outputs	0 V
AI3A	Differential analog input	± 10 V, impedance = 30 k Ω
AI3B	Differential analog input	
+10	Supply for analog inputs	+ 10 V, I _s = 10 mA maximum
-10	Supply for analog inputs	- 10 V, I _s = 10 mA maximum
AO	Analog output	0 - 20 mA, (x - y configurable) Load impedance = 500 Ω maximum
LI5	Logic inputs	2 logic inputs Impedance = 3.5 k Ω Supplied by +24 V
LI6		
+24	Supply for logic inputs	+24 V, I _s = 200 mA maximum [◆]
LO	Logic output	Open collector output
LO+	Supply for logic output	+24 V supply, I _s = 20 mA maximum

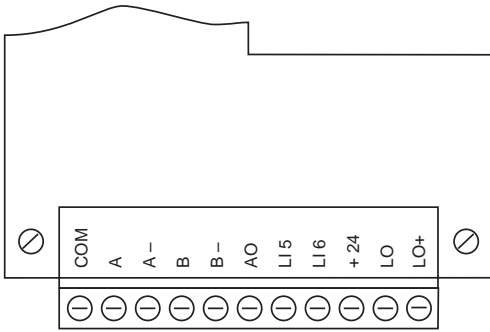
◆ The 200 mA is the sum of the current supplied by the +24 on the control board and the +24 on the I/O extension card.

Specifications

Available internal supplies	Protected against short circuits and overloads 1 output +10 V $\pm 1\%$, I _s = 10 mA maximum 1 output -10 V $\pm 1\%$, I _s = 10 mA maximum 1 output +24 V (20 V min., 30 V max.), I _s = 200 mA maximum [◆]
Logic Inputs LI	2 reassignable logic inputs. Impedance = 3.5 k Ω . Compatible with level 1 PLCs according to IEC 65A-68. Maximum shielded cable length: 330 ft (100 m). Supply: +24 Vac (11 V min., 30 V max.) State 0 if < 5 V, state 1 if > 11 V. The logic inputs are sampled every 5 ms, maximum.
Logic Output LO	1 reassignable open collector logic output, compatible with level 1 PLCs according to IEC 65A-68. Supply: +24 V (12 V min., 30 V max.), maximum current = 20 mA with internal source or 200 mA with external source. The logic output is updated every 5 ms, maximum.
Analog Output AO	1 reassignable 0 - 20 mA analog output, (x - y configurable). Maximum load impedance = 500 Ω . Resolution: 0.04 mA (9 bits) Linearity: ± 0.1 mA Accuracy: ± 0.2 mA The analog output is updated every 5 ms, maximum.
Analog Input AI	1 reassignable 0 ± 10 V bipolar differential input. Impedance = 30 k Ω . Adjustable gain. Maximum allowable voltage: ± 30 V Freq. reference resolution: 0.1 Hz for 100 Hz (0.1% of max. freq.), 10 bits plus sign. Accuracy: $\pm 0.5\%$ Linearity: $\pm 0.2\%$ of the maximum output frequency The analog input is sampled every 5 ms, maximum. Maximum length of shielded cable: 66 ft (20 m) If configured for thermal sensors, use 750 Ω maximum at 20 °C (68 °F) (three 250 Ω sensors in series).

◆ The 200 mA is the sum of the current supplied by the +24 on the control board and the +24 on the I/O extension card.

Altivar® 58 TRX AC Drives I/O Extension Cards



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Terminals for the I/O Extension Card with Encoder Inputs

I/O Extension Card with Encoder Inputs (VW3A58202U)

This card includes two 24 Vdc logic inputs, one 24 Vdc open collector logic output, one 0 to 20 mA X-Y configurable analog output, and A+, A-, B+, B- inputs which may be used for speed correction with an incremental encoder or with an inductive or photoelectric sensor.

The figure to the left shows the location of the terminals for this I/O card, while the tables below describe the terminals. See page 50 for a summary of configurable I/O functions.

Functions and Characteristics of Terminals

Terminal	Function	Characteristics
COM	Common	0 V At the same potential as COM on the main control board.
A	Incremental logic inputs	Nominal voltage 24 Vdc, Input impedance 785 Ω ±10%
A-		
B		
B-		
AO	Analog output	0 - 20 mA, (x - y configurable) Max. Load impedance = 500 Ω
LI5	Logic inputs	2 logic inputs Impedance = 3.5 kΩ Supplied by +24 V
LI6		
+24	Supply for logic inputs	+24 V, Is = 200 mA maximum♦
LO	Logic output	Open collector output
LO+	Supply for logic output	+24 V supply, Is = 20 mA maximum

♦ The 200 mA is the sum of the current supplied by the +24 on the control board and the +24 on the I/O extension card.

Specifications

Available internal supplies	Protected against short circuits and overloads 1 output +10 V ± 1%, Is = 10 mA maximum 1 output -10 V ±1%, Is = 10 mA maximum 1 output +24 V (20 V min., 30 V max.), Is = 200 mA maximum♦
Logic Inputs LI	2 reassignable logic inputs. Impedance = 3.5 kΩ. Compatible with level 1 PLCs according to IEC 60065A-68. Maximum shielded cable length: 330 ft (100 m). Supply: +24 Vac (11 V min., 30 V max.) State 0 if < 5 V, state 1 if > 11 V. The logic inputs are sampled every 2 ms, maximum.
Logic Output LO	1 reassignable open collector logic output, compatible with level 1 PLCs according to IEC 60065A-68. Supply: +24 V (12 V min., 30 V max.), maximum current = 20 mA with internal source or 200 mA with external source. The logic output is updated every 2 ms, maximum.
Analog Output AO	1 reassignable 0 - 20 mA analog output, (x - y configurable). Maximum load impedance = 500 Ω. Resolution: 0.04 mA (9 bits) Linearity: ± 0.1 mA Accuracy: ± 0.2 mA The analog output is updated every 2 ms, maximum.
Logic Inputs A, A-, B, B-	For incremental encoder (TTL, line driver, push pull) or open collector type (NPN detector, three-wire inductive, or photoelectric sensor). Nominal voltage: 24 Vdc (19.2 to 30 V). Input impedance: 785 Ω ±10%. Maximum signal frequency: 33 kHz with motor operating at drive controller high speed setting (HSP). It is preferable to use an external 24 V external supply for the incremental encoder.

♦ The 200 mA is the sum of the current supplied by the +24 on the control board and the +24 on the I/O extension card.

Pump Switching Option Card (VW3A58210U)

The pump switching option card can control a complete pumping installation using a single ATV58 TRX drive controller. It provides:

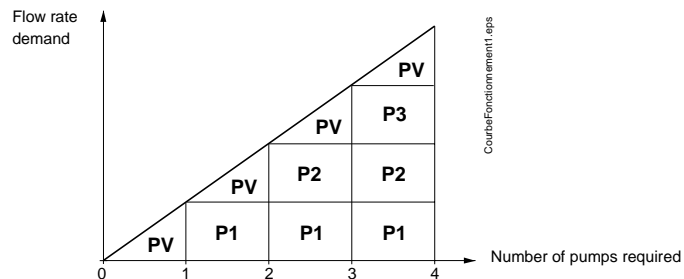
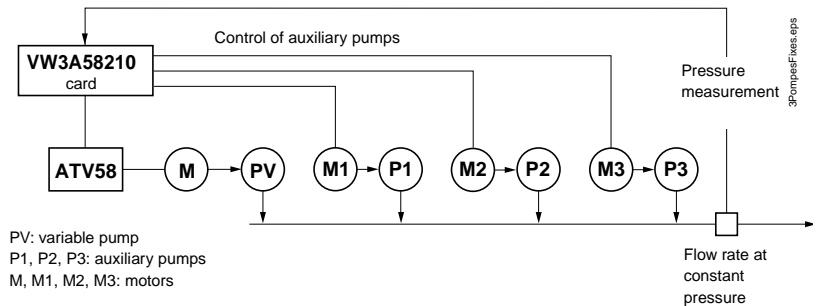
- Constant pressure in the system whatever the flow rate
- A simple method for installing and diagnosing the installation using the ATV58 TRX drive controller

The pump switching option card can operate up to four fixed speed pumps and one variable speed pump (the variable speed pump cannot provide the full flow range required on its own). A PI regulator is used for drive control and a pressure sensor is required to provide system feedback.

To prevent uneven wear of the pumps, the card allows pump switching according to operating time. The variable speed pump can be included in the swapping procedure.

Application Example (with 3 auxiliary pumps and one variable pump)

In this example, the auxiliary pumps are switched on and off according to the flow rate required by the installation. The variable pump is controlled to compensate for any flow rate variations.



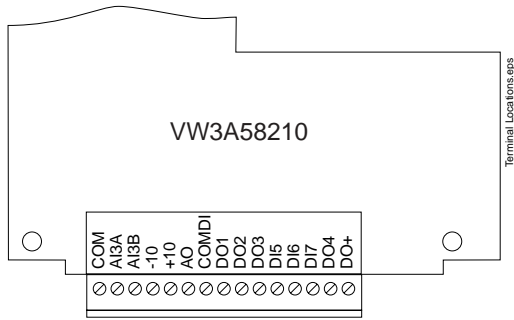
The ATV58 drive controller controls the pumps via logic outputs DO1, DO2, DO3 etc., depending on the operating mode programmed.

The logic inputs indicate the state of the pumps.

- If LI = 1, the pump is ready to start and used in the automatic sequencing.
- If LI = 0, the pump is not ready and will not be used in the automatic sequencing.

Internal elapsed timers are used to keep track of the accumulated operating time of each pump.

Altivar® 58 TRX AC Drives I/O Extension Cards



**Terminals for the
Pump Switching Option Card**

The following table describes the functions and characteristics of the pump switching option card control terminals.

Function	Characteristics
Available DC Power Supplies +10 and -10	Protected against short circuits and overloads 2 outputs, +10 Vdc and -10 Vdc Maximum current = 10 mA each
Digital Logic Inputs DI5, DI6, DI7	3 reassignable logic inputs. Impedance = 3.5 kΩ. Compatible with Level 1 PLCs according to IEC 60065A-68. Maximum shielded cable length: 330 ft (100 m). Supply: +24 V (11 V min., 30 V max.) State 0 if < 5 V, state 1 if > 11 V. The logic inputs are sampled every 2 ms, maximum.
Logic Outputs DO1, DO2, DO3, DO4	4 reassignable open collector logic output, compatible with Level 1 PLCs according to IEC 60065A-68. Supply: +24 V (12 V min., 30 V max.), maximum current = 200 mA each with external source. The logic output is updated every 2 ms, maximum.
Analog Output AO	1 reassignable 0–20 mA analog output Maximum load impedance = 500 Ω Resolution: 0.04 mA (9 bits) Linearity: ± 0.1 mA Accuracy: ± 0.2 mA The analog output is updated every 2 ms, maximum.
Analog Input AI3A, AI3B	1 reassignable, ±10 V bipolar differential input. Input Impedance: AI3A to AI3B > 300 kΩ AI3A to COM ≅ 30 kΩ AI3B to COM > 600 kΩ Maximum allowable voltage: ± 30 V. Frequency reference resolution: 0.1 Hz for 100 Hz (0.1% of maximum frequency), 10 bits plus sign. Accuracy: ± 0.5%. Linearity: ± 0.2% of the maximum output frequency. The analog input is sampled every 2 ms, maximum. Maximum length of shielded cable: 66 ft (20 m).
COM	0 Vdc Common for analog input signal
COM DI	0 Vdc Common for logic inputs, logic outputs, and analog output
External Logic Output Power DO+	Input: +24 Vdc nominal (12 Vdc min., 30 Vdc max.) Maximum current = 200 mA per logic output.

[1] Maximum wire size capacity 1.5 mm² (AWG 14).
Recommended tightening torque is 3.54 lb-in (0.4 N•m).

NOTE: There is no +24 Vdc power supply output on this option card; therefore, it is necessary to connect an external +24 Vdc power source between terminals DO+ (+) and COMDI (-).

115 VAC Logic Input Module (VW3A58275U)

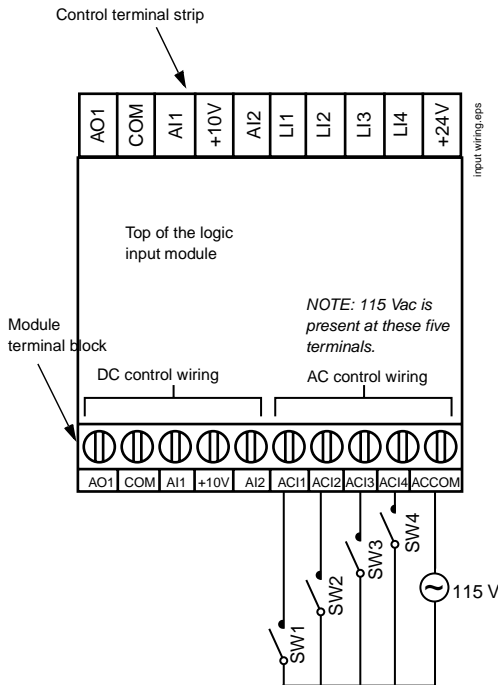
The 115 Vac logic input module, catalog number VW3A58275U, makes it possible to use ATV58 TRX control terminal points LI1, LI2, LI3, and LI4 with control circuits that require 115 Vac control. The module insulates the 115 Vac signals from the 24 Vdc input signals of the drive controller terminal strip, without modifying the other signals.

The 115 Vac logic input module is designed for use only on the Type H and Type N families of ATV58 TRX drive controllers. It requires no special programming.

Drive controller logic inputs LI1, LI2, LI3, and LI4 retain their functionality when using this module. These inputs correspond to the module inputs labeled ACI1, ACI2, ACI3, and ACI4 respectively.

The figure at the left shows typical wiring using four switches, operating on 115 Vac, as inputs to the drive controller. Power is derived from a 115 Vac power source wired to the switches, then to inputs ACI1–ACI4. The 115 Vac common must be connected to the ACCOM terminal on the module.

See the table below for electrical specifications. The module accepts 26–16 AWG (0.14–1.3 mm²) wire.



115 Vac Logic Input Module Typical Wiring

ACI1 ACI2 ACI3 ACI4	Frequency	47 to 63 Hz
	Input Impedance	28 kΩ ±10% @ 25 °C (77 °F)
	Maximum Allowable Voltage Range	0–132 Vrms
	Input to Guarantee On State	90 to 132 Vrms
	Input to Guarantee Off State ^a	0 to 50 Vrms
Storage Temperature		-25 to 70 °C (-13 to 158 °F)

a. Coupling can cause voltages higher than 50 Vrms, which can turn the input on or prevent it from turning off.

Altivar® 58 TRX AC Drives

Communication Options



Communication Options

COMMUNICATION OPTIONS

All ATV58 TRX functions are available with the communication options:

- Configuration (accessible in read and write modes): motor frequency, motor voltage, ramp profiles, I/O assignment, etc.
- Adjustments (accessible in read and write modes): DC injection time and amplitude, thermal protection, speed range, ramp time, current limitation, etc.
- Control (accessible in read and write modes): start/stop, braking, frequency reference, fault reset, etc.
- Display (accessible in read only mode): speed controller status register, motor speed, motor current, logic I/O status register, fault register, etc.
- Authorization of local control (via terminal block).

Twelve communication options are available:

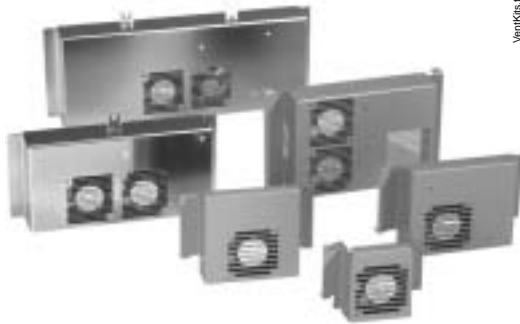
- FIPIO (VW3A58301U or VW3A58311 for ATV58 TRX 125–500 hp and Type FVC)
This card is equipped with a male 9-pin SUB-D connector, which will accept a TSX FP ACC2 mobile connector for ATV58 TRX Type E and Type F models or a TSX FP ACC12 mobile connector for ATV58 TRX Type H and Type FVC models.
- Modbus Plus (VW3A58302U)
This card is equipped with a female 9-pin SUB-D connector, which will accept a Modbus Plus drop cable equipped with connectors (reference 990NAD21910 or 990NAD21930) to be connected on a T-junction box (990NAD23000) for connection to the Modbus Plus main cable (490NAA271••).
- Modbus RTU/Jbus, Modbus ASCII, Uni-Telway (VW3A58303U)
This card is equipped with a female 9-pin SUB-D connector and includes a 3-meter (9.8 foot) cable equipped with a male 9-pin connector and a male 15-pin connector.
- Interbus-S (VW3A58304EU)
This card is equipped with two male and female 9-pin SUB-D connectors for connection to cables equipped with connectors. It is also equipped with two screw terminals for a separate 24 Vdc power supply (200 mA minimum, which must be ordered separately).
- AS-i Bus (VW3A58305)
This card is equipped with a removable terminal block. This protocol offers the lowest level of control.
- Profibus DP (VW3A58307U)
This card is equipped with a female 9-pin SUB-D connector for connection to cables equipped with connectors. The kit contains a set-up diskette for PLC configuration.
- CANopen (VW3A58308)
This card is equipped with a removable five-pin connector.
- Device Net (VW3A58309U)
This card is equipped with a removable five-pin connector. This option card has been tested for compliance by an ODVA test facility.
- Ethernet Modbus TCP/IP (VW3A58310U)
This card is equipped with a RJ45 connector. The cables and hubs are the same as Schneider Electric's Transparent Factory Ethernet products. The card allows direct IP addressing through web pages embedded in the card.
- Lonworks to Modbus Gateway (VW3A58312PU)
This DIN rail mountable gateway is a Lonworks to Modbus protocol converter. The module is connected point-to-point through the supplied cable to either the ATV58 integrated keypad Modbus port or to the 9-pin connector on the Modbus option card (VW3A58303U).
- Johnson Controls METASYS N2 (VW3A58354U)
This card allows the ATV58 TRX drive controller to be integrated into an N2 network as an application-specific controller. It is equipped with a female 9-pin SUB-D connector.
- Siemens P1 Gateway
This gateway is available through third party arrangement.

VENTILATION KITS

Ventilation kits enable the ATV58 TRX controller to operate at a higher ambient temperature as, for example, when mounted in an enclosure. The circulation of air around the electronic cards prevents the formation of hot spots. The fan kit attaches to the upper part of the controller, and is powered by the drive controller.

A ventilation kit contains the fan assembly, all necessary mounting accessories, and a power cable connector that plugs into the power board on the drive controller.

See page 115 for temperature ratings and page 125 for dimensions.



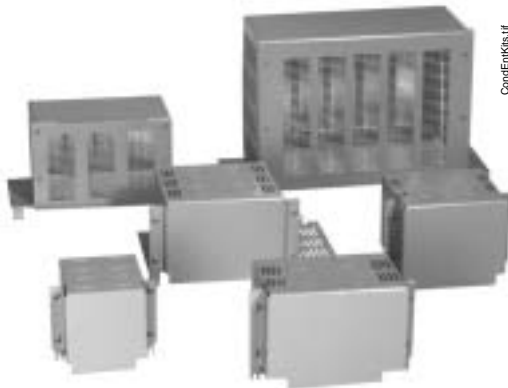
VentKits.tif

Ventilation Kits

Ventilation Kit for	Catalog Number
ATV58•U09M2, ATV58•U18M2	VW3A58821
ATV58•U29M2, ATV58•U41M2, ATV58•U18N4, ATV58•U41N4	VW3A58822
ATV58•U54M2, ATV58•U72M2, ATV58•U54N4, ATV58•U72N4, ATV58•U90N4	VW3A58823
ATV58•U90M2, ATV58•D12M2, ATV58•D12N4, ATV58•D16N4, ATV58•D23N4	VW3A58824
ATV58HD16M2X, ATV58HD23M2X, ATV58HD28N4, ATV58HD33N4, ATV58HD46N4, ATV58HD28N4X, ATV58HD33N4X, ATV58HD46N4X	VW3A58825
ATV58HD28M2X, ATV58HD33M2X, ATV58HD46M2X, ATV58HD54N4, ATV58HD64N4, ATV58HD79N4, ATV58HD54N4X, ATV58HD64N4X, ATV58HD79N4X	VW3A58826

CONDUIT ENTRY KITS

Conduit Entry Kits are for use on wall-mounted drive controllers. A conduit entry kit attaches to the bottom of the drive and provides multiple knockouts to land conduit for power and control wire. The available kits are shown in the table below. See page 115 for enclosure ratings and pages 123–124 for dimensions.



ConduitEntryKits.tif

Conduit Entry Kits

Catalog Number	For Drive Controllers	
	230 Vac	460 Vac
VW3A58842	ATV58HU09M2 ATV58HU18M2	—
VW3A58843	ATV58HU29M2 ATV58HU41M2	ATV58HU18N4 ATV58HU29N4 ATV58HU41N4
VW3A58844	ATV58HU54M2 ATV58HU72M2	ATV58U54N4 ATV58U72N4 ATV58U90N4
VW3A58845	ATV58HU90M2 ATV58HD12M2	ATV58HD12N4 ATV58HD16N4 ATV58HD23N4
VW3A58846	ATV58HD16M2 ATV58HD23M2	ATV58HD28N4 ATV58HD23N4 ATV58HD46N4
VW3A58847	ATV58HD28M2 ATV58HD33M2 ATV58HD46M2	ATV58HD54N4 ATV58HD64N4 ATV58HD79N4
VW3A58848 ¹		ATV58HC10N4X
VW3A58849 ¹		ATV58HC13N4X ATV58HC15N4X ATV58HC19N4X
VW3A58850 ¹		ATV58HC23N4X ATV58HC25N4X ATV58HC28N4X ATV58HC31N4X ATV58HC33N4X

¹ Availability to be announced.

Altivar® 58 TRX AC Drives

Dynamic Braking Resistor Kits

DYNAMIC BRAKING RESISTOR KITS

The dynamic braking resistor kit allows the ATV58 TRX drive controllers to function in quadrants 2 and 4 of the four quadrant speed/torque curve. In these quadrants of motor operation, the motor is essentially a generator through which energy is transferred from the motor load back to the drive controller. This results in elevated DC bus voltage to the drive controller which may cause it to shutdown to protect itself. Dynamic braking resistor kits are commonly used to dissipate the excess energy generated by the motor operating in this mode. The flow of current to the braking resistor is controlled by the dynamic braking transistor (see the block diagrams on page 92–94).

The following table shows the minimum ohmic value of the resistor that can be used with the ATV58 TRX drive controllers. Using lower than recommended values will cause excessive current flow, exceeding the rating of the dynamic braking transistor.

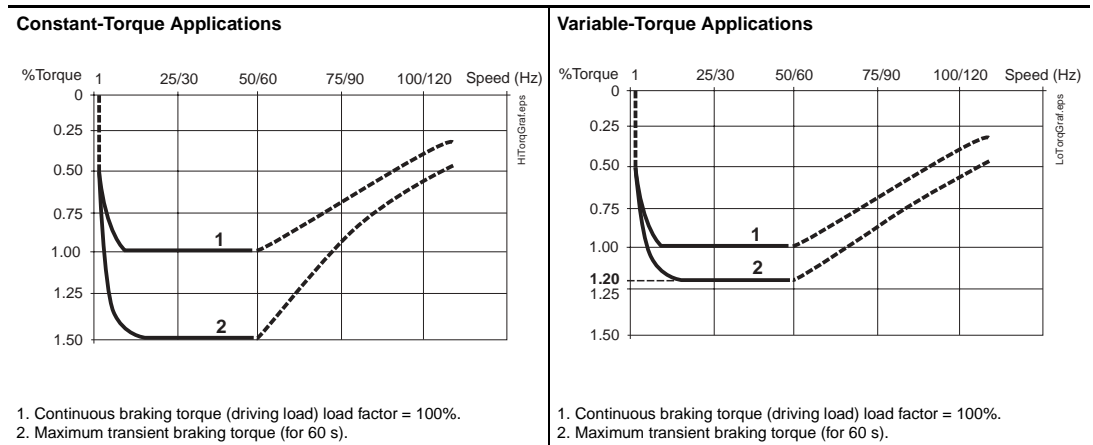
Minimum Ohmic Value of Resistors Which Can Be Used with ATV58 TRX Controllers

Model (ATV58)	Minimum Resistance Value in Ohms	Model (ATV58)	Minimum Resistance Value in Ohms
U09M2 U18M2	75	U18N4 U29N4 U41N4 U54N4	85
U29M2 U41M2	38	U72N4	57
U54M2	31	U90N4	47
U72M2	25	D12N4	53
U72M2 D12M2	13	D16N4 D23N4	19
D16M2X	8	D28N4, D28N4X D33N4, D33N4X D46N4, D46N4X	14
D23M2X	8		
D28M2X	4		
D33M2X	2.67	D54N4, D54N4X	8
D46M2X	2.67		
		D64N4, D64N4X D79N4, D79N4X	5

The following charts show the motor braking torque capacity of an ATV58 TRX drive controller with a braking resistor.

Characteristics of Braking Module and Resistors

Braking Torque with Resistor



Calculating Resistor Size

The standard dynamic braking (DB) resistor assemblies are suitable for a wide variety of drive system stopping applications. However, when the driven machinery may present an overhauling load or large inertia to the drive system, the suitability of the DB resistor assembly should be checked.

The suitability of a DB resistor assembly is determined by analyzing the mechanical system of the driven machinery. From the analysis, the following key parameters are computed:

- The peak braking power required during stopping or speed changes (P_i). The value of P_i determines the maximum allowable ohmic value of the DB resistor.
- The amount of power that must be absorbed (P_d) for a given time (t_d) by the DB resistors during stopping or speed changes of the drive. The value of P_d and t_d determine the required time-current characteristic of the DB resistor.
- The calculation of dynamic braking power requires V_{db} .
- $V_{db} = 850$ V for 460 V drives
 $V_{db} = 375$ V for 230 V drives
- The average power that must be dissipated by the DB resistor during an entire cycle of the machine (P_a). The value of P_a determines the required continuous current rating of the DB resistor.

The following example illustrates the process:

Given

The application consists of a 5 hp, 460 Vac, 1740 rpm motor (N_{base} = base speed) with a rotor inertia of 0.28 lb-ft². The motor is being controlled by an ATV58HU72N4 operating in the constant torque mode. The motor is driving a machine with an inertia 10 times that of the motor with no interposing gear box. The machine resistive (friction) torque is one-tenth of the rated motor torque at full speed. The requirement is to stop in 5 seconds from rated speed at a rate of 2 cycles/minute.

Mechanical System Parameters:

Rated motor torque: $T_n = (\text{hp} \times 5250)/N_{base} = (5 \times 5250)/1740 = 15.1$ lb-ft

Machine cycle time: $t_c = (60 \text{ seconds})/(\text{two operations per minute}) = 30$ seconds

Machine speed change during deceleration: $N_d = 1740 \text{ rpm} - 0 \text{ rpm} = 1740$ rpm

Machine deceleration time: $t_d = 5$ seconds

Mechanical system resistive (friction) torque: $T_r = (15.1 \text{ lb-ft})/10 = 1.51$ lb-ft

Mechanical system overhauling torque: $T_o = 0.00$ lb-ft

Mechanical system combined inertia: $J_c = 0.28 \text{ lb-ft}^2 + (10) \times 0.28 \text{ lb-ft}^2 = 3.08 \text{ lb-ft}^2$

Mechanical system inertial torque for a 5 second deceleration rate (as set by controller deceleration ramp):

$$T_j = J_c \times (N_d)/(308 \times (t_d)) = 3.08 \times 1740/(308 \times 5) = 3.48 \text{ lb-ft}$$

Required braking torque from motor: $T_b = T_j + T_o - T_r = 3.48 + 0.00 - 1.51 = 1.97$ lb-ft

NOTE: The required braking torque must not exceed the motor's ability to produce torque. For inertial loads, including those depicted in the above examples, the required braking torque must not exceed the torque producing ability of the dynamic braking unit with the recommended braking resistor (approximately 1.5 times the motor rated torque for constant torque applications).

For machines that can continuously overhaul the motor, the value of overhauling torque (T_o) minus the resistive torque (T_r) must not exceed the motor continuous torque rating at any speed.

Altivar® 58 TRX AC Drives Dynamic Braking Resistor Kits

DB resistor requirements:

Peak braking power required to develop braking torque (T_b) when decelerating from a given speed

$$P_i = T_b \times N_{base} / (7.04) = (1.97 \times 1740) / (7.04) = 487 \text{ W}$$

The braking power that must be absorbed for a time (t_d) during stopping or speed changing operation: $P_d = 0.5 \times P_i = 0.5 \times 487 = 243 \text{ W}$ for a period of t_d seconds

The average braking power that must be dissipated during a machine cycle:

$$P_a = P_d \times t_d / t_c = 243 \times 5 / 30 = 40.5 \text{ W}$$

Capability of VW3A66711 DB resistor assembly for ATV58U72N4 controller:

Peak braking power that can be developed with VW3A66711 DB resistor assembly with controller configured for 460 Vac input line operation: $P_i = (V_{db})^2 / R_{db} = (850 \text{ V})^2 / 120 \Omega = 6020 \text{ W}$

The braking power that can be absorbed for t_d (based on DB resistor hot state current-time characteristic curve shown on page 37):

$$P_d = R_{db} \times ((\text{Multiple of } I_r \text{ at } t_d) \times I_r)^2 = 120 \Omega \times (3.5 \times 1.0)^2 = 1470 \text{ W}$$

Since R_{db} limits the peak current that can be drawn from the drive controller DC bus, the value of $[(\text{Multiple of } I_r) \times I_r]$ must be limited to no greater than $(\sqrt{P_i / R_{db}})$.

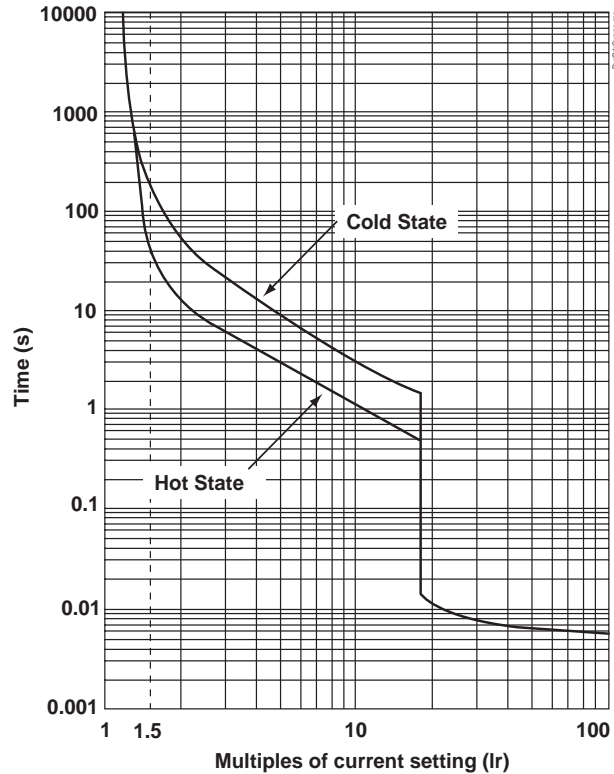
The average braking power that can be dissipated continuously:

$$P_a = R_{db} \times (I_r)^2 = 120 \Omega \times (1)^2 = 120 \text{ W}$$

For this example, the VW3A66711 DB resistor assembly will work as intended for the application.

Current/Time Characteristics for DB Resistor Assemblies

The figure below shows the allowable GV2 trip times as a function of current setting multiples with the dynamic braking resistor assembly located in a 40 °C (104 °F) ambient temperature environment. See page 35 for an example of how to calculate resistor size.



The kits in the following table use the thermal protection of a GV2 manual starter and have a Type 1 rating per UL 50. The insulation system is suitable for use in a Pollution Degree 3 environment (refer to NEMA ICS-1 Annex A). The package is UL/CSA marked.

DB Kits Technical Specifications

Dynamic Braking Kit for:	Ohmic Value (Rdb)	Continuous Current Rating of Assembly♦ (Ir)	Average Power (W)	Catalog Number
ATV58•U09M2▼, ATV58•U18M2▼, ATV58•U18N4, ATV58•U29N4, ATV58•U41N4, ATV58•U54N4, ATV58•U72N4	120 Ω	1.0 A	120	VW3A66711
ATV58•U29M2, ATV58•U41M2, ATV58•U90N4, ATV58•D12N4	56 Ω	1.45 A	118	VW3A66712
ATV58•U54M2, ATV58•U72M2, ATV58•D16N4, ATV58•D23N4	28 Ω	2.7 A	204	VW3A66713
ATV58•U90M2, ATV58•D12M2, ATV58•D28N4, ATV58•D33N4, ATV58•D46N4	14 Ω	3.8 A	202	VW3A66714
ATV58•D16M2, ATV58•D23M2, ATV58•D54N4	10 Ω	10.0 A	1000	VW3A66715
ATV58•D28M2, ATV58•D33M2, ATV58•D46M2, ATV58•D64N4, ATV58•D79N4	5 Ω	14.0 A	980	VW3A66716

♦ Current rating of resistor assembly is calculated based on setting of internal overload protective device in assembly, overload setting based on enclosure overtemperature protection, and resistor overload versus time characteristics. Resistors are rated for stopping six times rotor inertia of four-pole motor with drive at current limit. Motor inertias are based on NEMA MG-1 14.45.

▼ Requires external braking transistor, VW3A58701.

ELECTROMAGNETIC COMPATIBILITY (EMC) KITS

ATV58 TRX drive controllers are marked with the CE European Community mark.

The ATV58 TRX drive controller is considered to be a component. It is neither a machine nor a piece of equipment ready for use in accordance with the European Community directives (machinery directive or electromagnetic compatibility directive). It is the user's responsibility to ensure that the machine meets these standards.

Metal EMC plate kits are available for ATV58 TRX drive controllers to assist in meeting the European Community EMC directives. The plate is used for landing the shield of the shielded cable. These kits are for integrators and end-users who are including the drive controller as part of a machine to be exported to Europe requiring compliance to these directives. When installed as directed in Instruction Bulletin 30072-450-04 (shipped with the kit), the requirements of EMC Directive Level A will be met. To achieve Level B compliance, install an external RFI filter (see the following sections). See page 125 for EMC kit dimensions.

EMC Kit Catalog Numbers

For Drive Controllers	EMC Kit Catalog Number
ATV58•U09M2, ATV58•U18M2	VW3A58831
ATV58•U29M2, ATV58•U41M2, ATV58•U18N4, ATV58•U29N4, ATV58•U41N4	VW3A58832
ATV58U54M2, ATV58U72M2, ATV58U54N4, ATV58U72N4, ATV58U90N4	VW3A58833
ATV58U90M2, ATV58D12M2, ATV58D12N4, ATV58D16N4, ATV58D23N4	VW3A58834

INTERNAL RFI FILTERS

The ATV58 TRX drive controller can be supplied with internal radio interference suppression input filters to comply with the EMC “products” standards IEC 61800-3 and EN 61800-3 concerning variable speed controllers. Compliance with these standards meets the requirements of the European directive on EMC.

The following ATV58 TRX controllers are available without input filters for use in situations where EMC conformity is not necessary:

- ATV58HU54N4 to ATV58HD79N4 drive controllers are available with or without integrated input filters. If the catalog number includes an “X”, the drive controller does not have an integrated input filter.
- ATV58HD16M2X to ATV58HD46M2X drive controllers are not available with integrated input filters.

The following ATV58 TRX drive controllers are always supplied with integrated input filters:

- ATV58•U09M2 to ATV58•D12M2 drive controllers; and
- ATV58•U18N4 to ATV58•U41N4 drive controllers.

EXTERNAL RFI FILTERS

External RFI input filters are available to meet the strictest requirements. These filters are designed to reduce conducted emissions on the mains supply to below the limits of standards EN 55022 class B or EN 55011 class A. The motor cable must be longer than 5 m (16 feet) for ATV58•U09M2 to ATV58•D12M2 and ATV58•U18N4 to ATV58•D23N4 controllers, or 25 m (82 feet) for ATV58HD28N4 to ATV58HD79N4 controllers.

External RFI filters are mounted beneath ATV58 TRX Type H controllers. They have tapped holes for mounting the drive controller which they support. The filters are mounted to the side of ATV58 TRX Type E controllers.

Because the filter needs a direct path to ground to work properly, RFI filters can only be used on wiring systems with a neutral connected directly to ground. Do not use RFI filters on wiring systems grounded through a high impedance or on systems with an isolated (floating) neutral.

Altivar® 58 TRX AC Drives Line Reactors and Output Filters

Wiring systems with a neutral connected directly to ground can be classified in two ways, as TT or TN.

1. TT indicates a neutral wire connected directly to ground. The exposed conductive parts of the product are connected to ground via a separate path.
2. TN indicates a neutral wire connected directly to ground and the exposed conductive parts of the product are connected to ground via the same path.

Wiring systems grounded through a high impedance or systems with an isolated (floating) neutral can be referred to as IT. Standard IEC 1800-3, appendix D2.1, states that filters must not be used with IT mains supplies because they prevent the ground leakage detectors from working reliably. In addition, the effectiveness of the filters on IT mains supplies depends on the type of impedance between neutral and earth, and is therefore not recommended.

In the case of a machine which must be installed on an IT supply, the solution is to insert an isolation transformer and operate the machine locally using a TN or TT supply.

Characteristics

Conformity to standards		EN 133200
Degree of protection		IP 21 and IP 41 on upper part
Maximum relative humidity		93% with no condensation or dripping water, conforming to IEC 68-2-3
Ambient air temperature	Operation	-10 to 60 °C (14 to 140 °F)
	Storage	-25 to 70 °C (-13 to 158 °F)
Operating altitude	Up to 1000 m (3280 feet)	No derating required
	Above 1000 m (3280 feet)	Derate the current by 1% for each additional 100 m (328 feet)
Maximum nominal voltage	50/60 Hz single-phase	240 Vac +10%
	50/60 Hz 3-phase	500 Vac +10%

Refer to page 125 for dimensions and to page 132 for selection.

LINE REACTORS

Line reactors can improve protection against line overvoltage surges and reduce input currents to the drive controller by adding impedance. The additional impedance also reduces the harmonic current distortion produced by a typical 6-pulse diode rectifier used to convert AC to DC in most drive controllers. Additional impedance is recommended when the impedance of the power distribution system is low, such as when the power rating of the system transformer is ten times larger than the power rating of the drive controller. Single-phase line reactors are available for single-phase input rated ATV58 TRX Type H drive controllers. See pages 125, 132, and 133 for dimensions and selection.

MOTOR PROTECTING OUTPUT FILTERS

The motor protecting output filters combine inductance, capacitance, and resistance to form a low pass filter. They should be considered for use in applications where the wiring to the motor(s) is longer than 100 ft. (30.5 m). These filters lower the dv/dt levels to prevent exciting the natural resonant frequency of the output circuit (drive controller, motor cables, and motor). Motors compliant to NEMA MG1, Part 31 guidelines generally do not require the use of motor protecting filters. See page 133 for dimensions and selection.

Altivar® 58 TRX AC Drives

Macro-Configuration Programming

MACRO-CONFIGURATION PROGRAMMING

ATV58 TRX drives have a macro-configuration menu that can be used to pre-program the drive for the application to simplify configuration. Three options are available:

- Material handling (factory default setting)
- General use
- Variable torque

NOTE: 125–500 hp drive controllers have only the variable torque macro.

Selecting one of the macro-configurations will automatically assign the functions, parameters, and I/O of the ATV58 TRX controller and option cards (if installed). These configurations can be modified at any time if necessary. If a configuration is modified, the drive controller will display “customized” in place of the name of the macro-configuration previously selected.

The pre-configured functions for each macro-configuration are shown in the table below.

Factory-Configured Functions for the Three Macro-Configurations

	Material Handling ^[1]	General Use	Variable Torque
Basic I/O			
Logic input LI1	Forward	Forward	Forward
Logic input LI2	Reverse	Reverse	Reverse
Logic input LI3	2 preset speeds	Jog operation	Auto-Manual ^[3]
Logic input LI4	4 preset speeds	Freewheel stop/Run permissive ^[2]	DC injection braking ^[3]
Analog input AI1	Reference summing	Reference summing	Speed reference 1 ^[3]
Analog input AI2	Reference summing	Reference summing	Speed reference 2 ^[3]
Analog output AO1	Motor frequency	Motor frequency	Motor frequency
Relay R1	Drive fault relay	Drive fault relay	Drive fault relay
Relay R2	Output contactor control	Motor thermal state attained	Frequency reference attained ^[3]
Analog or Digital I/O Extension Cards			
Logic input LI5	8 preset speeds	Fault reset	Freewheel stop
Logic input LI6	Fault reset	Current limit	Ramp switching
Analog input AI3 (analog I/O card) or Encoder Inputs (digital I/O card)	Summing speed reference	Summing speed reference	PI regulator
	Speed regulation	Speed regulation	Speed regulation
Logic output LO	Current threshold attained	Output contactor control	High speed attained
Analog output AO	Motor current	Motor current	Motor current

[1] Factory default setting for 100 hp products and below.

[2] If the Freewheel Stop/Run Permissive function is configured, the drive controller will not start the motor unless the logic input is connected to +24 V.

[3] For 125–500 hp controllers, the factory settings are:
LI3 = fault reset; LI4 = Not assigned; AI1 = Reference summing; AI2 = Reference summing; R2 = Drive running.

DRIVE CONTROLLER IDENTIFICATION SCREEN: INCREASING POWER RATING FOR VARIABLE TORQUE APPLICATIONS

This screen can always be displayed, and shows the power rating and voltage of the drive controller. It can also be used to increase the power rating for variable torque applications using 208/230 Vac drive controllers of at least 10 hp or 460 Vac drive controllers of 3 to 100 hp.

DISPLAY PARAMETERS

The Display parameters, described in the following tables, can be viewed in any access level from the Display Menu. Use the arrow keys on the keypad display or programming terminal to scroll through this parameter set. The following parameters can be viewed under Drive State in the Display Menu. They are used for monitoring drive controller operation.

Parameter	STATUS	Description
Drive State	RDY	Drive controller is ready to run.
	RUN	Drive controller and motor are running in a steady state.
	ACC	Drive controller is accelerating the motor.
	DEC	Drive controller is decelerating the motor.
	CLI	Drive controller is in current limit.
	DCB	Drive controller is injecting DC current for braking the motor.
	NST	Drive controller has been commanded to freewheel stop.
	OBR	Drive controller is decelerating the motor as fast as possible.

The following parameters can also be viewed from the Display Menu.

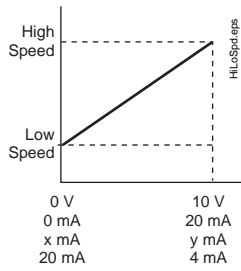
Parameter	Units	Description																								
Reference Frequency	Hz	Displays the frequency the drive controller is commanded to run. (If using the keypad to control the drive, the speed reference can be entered at this screen.)																								
Output Frequency	Hz	Displays the output frequency being applied to the motor.																								
Motor Speed	rpm	Motor speed in RPM based on user specified motor RPM.																								
Motor Current	A	Current being drawn by the motor.																								
Machine Speed	---	Value displayed based on user specified scaling factor multiplied by the output frequency. The scaling factor has a range of 0.01 to 100.																								
Output Power	%	Displays the percent of power the being drawn by the motor. 100% corresponds to nominal current rating of the drive.																								
Line Voltage	Volts	Displays the voltage measured at the input of the drive.																								
Motor Thermal	%	Displays the thermal state of the motor. 100% corresponds to nominal motor thermal state.																								
Drive Thermal	%	Displays the thermal state of the drive controller. 100% corresponds to nominal drive controller thermal state.																								
Last Fault		The following faults can be displayed: <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">Input phase loss</td> <td style="width: 33%;">Undervoltage</td> <td style="width: 33%;">Overvoltage,</td> </tr> <tr> <td>Drive overheating</td> <td>Motor overload</td> <td>Overbraking</td> </tr> <tr> <td>Motor phase loss</td> <td>Loss of 4-20mA signal</td> <td>Overcurrent</td> </tr> <tr> <td>Motor short circuit</td> <td>Pre-charge fault</td> <td>Loss of RS-485</td> </tr> <tr> <td>Motor overheating</td> <td>Thermal sensor fault</td> <td>EEPROM fault</td> </tr> <tr> <td>Internal fault</td> <td>External fault</td> <td>Overspeed</td> </tr> <tr> <td>Speed feedback fault</td> <td>Ramp not followed</td> <td>Config. fault</td> </tr> <tr> <td>Communication Network fault</td> <td>Internal comm fault</td> <td>Option removed</td> </tr> </table>	Input phase loss	Undervoltage	Overvoltage,	Drive overheating	Motor overload	Overbraking	Motor phase loss	Loss of 4-20mA signal	Overcurrent	Motor short circuit	Pre-charge fault	Loss of RS-485	Motor overheating	Thermal sensor fault	EEPROM fault	Internal fault	External fault	Overspeed	Speed feedback fault	Ramp not followed	Config. fault	Communication Network fault	Internal comm fault	Option removed
Input phase loss	Undervoltage	Overvoltage,																								
Drive overheating	Motor overload	Overbraking																								
Motor phase loss	Loss of 4-20mA signal	Overcurrent																								
Motor short circuit	Pre-charge fault	Loss of RS-485																								
Motor overheating	Thermal sensor fault	EEPROM fault																								
Internal fault	External fault	Overspeed																								
Speed feedback fault	Ramp not followed	Config. fault																								
Communication Network fault	Internal comm fault	Option removed																								
Watt-Hour Meter	kWh or MWh	Displays energy consumed in kWh or MWh when kWh reaches 9999																								
Run Time Meter	hrs	Operating time (motor powered) in hours																								

Altivar® 58 TRX AC Drives

Adjustment Parameters

ADJUSTMENT PARAMETERS

Adjustment parameters can be viewed and modified when the access locking switch on the keypad display is not locked (see page 24). Adjustment parameters can be modified with the motor stopped or running.



Low Speed and High Speed Diagram

Low Speed and High Speed

These frequency limits define the speed range permitted, as shown in the graph to the left. Low speed is adjustable from 0 to the High Speed setting and is factory set at 0 Hz. High Speed is adjustable from Low Speed to 500 Hz and is factory set to 50 or 60 Hz, depending on the configuration. The speed reference input is scaled between Low Speed and High Speed. It is possible to modify the scaling with the Low Speed Operation parameter.

Low Speed Operation

The Low Speed Operation parameter determines the two limits, High Speed (HSP) and Low Speed (LSP), that define the speed range permitted by the machine under actual operating conditions. This function can be used for all applications. The following table describes the three settings that can be assigned for this function.

Normal Mode	Pedestal Mode	Deadband Mode

LSP (Low Speed): From 0 to HSP, preset at 0. HSP (High Speed): from LSP to FMAX, preset at 50/60 Hz
 x: configured from 0 to 20 mA, preset at 4 mA y: configured from 4 to 20 mA, preset at 20 mA

Maximum Frequency

Maximum Frequency is used as a maximum speed clamp. The High Speed setting can not be above the Maximum Frequency setting. Maximum Frequency is adjustable from 40 to 500 Hz and factory set to 60 Hz or 72 Hz depending on the 50/60 Hz switch configuration.

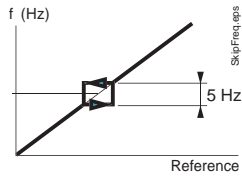
Acceleration and Deceleration Ramp Times

The ramp times for acceleration and deceleration are determined by the requirements of the application and the dynamics of the machine. The following table shows the acceleration and deceleration settings.

Acceleration	Deceleration
Adjustment from 0.05 to 999.9 s, preset at 3 s.	Adjustment from 0.05 to 999.9 s, preset at 3 s.

Electronic Inversion of Output Phase

This parameter can be used to change the direction of motor rotation. This parameter is useful if it is determined, after the motor wiring has been connected, that the motor is not rotating in the correct direction.



Skip Frequency Diagram

Skip Frequency

This parameter, also referred to as jump frequency, allows suppression of a critical speed which causes mechanical resonance phenomena. Prolonged operation of the motor within a frequency band of 5 Hz is prohibited. The frequency band is adjustable over the speed range. A representation of this is shown to the left. There are three skip frequency settings.

This function is useful for applications involving light-weight machines, such as bulk product conveyors, with unbalanced motors. It is also useful for applications involving fans and centrifugal pumps.

Low Speed Run Time Limit

This function, also referred to as a sleep function, is used to stop the motor after running at low speed for a programmed amount of time, with the run command present and zero speed reference. The length of run time at low speed is adjustable from 0.1 to 999.9 seconds. The factory setting is 0 s, which disables this function. The motor will re-start if the frequency reference becomes greater than the low speed or the run command is cycled.

This function can be used for automatic starting and stopping of pressure-regulated pumps.

IR Compensation

This parameter is used to adjust low-speed torque for optimal performance. Adjust this parameter to compensate for the resistive voltage drop of the motor stator windings and the conductors connecting the motor and drive controller.

The factory setting is 100%, with a range of 0 to 150%. (If using special motors such as synchronous permanent magnet motors, synchronous wound field motors, or synchronous reluctance motors, the adjustment range can be expanded and is 0 to 800%.)

This parameter is typically used to boost torque performance during low speed operation. If an auto-tune is performed, adjustment of this parameter is usually not required.

Slip Compensation

This parameter is used to adjust the slip compensation to improve speed regulation. The factory setting is 100%, with a range of 0 to 150%.

Induction motors develop torque based on the slip, which is the difference between the speed of the rotating magnetic field in the stator and the speed of the rotor. As the load increases, the slip increases to produce the necessary torque. In applications where the change in speed due to slip is undesirable, the slip compensation should be increased. When this parameter is increased, the drive controller will automatically increase the output frequency. The amount of increase is proportional to the increase of the load, allowing one setting for the entire speed range.

Gain

This parameter allows adjustment of the drive controller's response time to sudden changes in the motor load. The factory setting is 20%, with a range of 0 to 100%.

Decreasing the gain parameter slows the response time of the drive. Increasing the gain parameter makes the drive respond more quickly. This parameter should be increased when it is not desirable for motor speed to change as the motor load changes, such as in applications that have fast cycle times or high torque requirements.

Stability

This parameter allows adjustment of speed overshoot of the drive controller to sudden changes in the motor load. The factory setting is 20%, with a range of 0 to 100%.

Increasing the stability setting dampens the overshoot. This parameter should be adjusted with the gain setting to tune the drive response to meet desired performance on applications that have fast cycle times or high torque requirements.

Altivar® 58 TRX AC Drives

Drive and Motor Configuration Parameters

DC Current Injection

This parameter allows the drive to inject DC current into the stator, creating a stationary magnetic pole which brakes the rotor at the end of each stop command when the frequency drops below 0.1 Hz.

This feature is useful when a coasting motor is undesirable at the end of the deceleration ramp. The factory setting for this feature is "enabled". The time of DC current injection is adjustable from 0 to 30 seconds, with a factory setting of 0.5 seconds. A continuous setting is also available. If the continuous setting is selected, the drive controller brakes at the nominal current rating of the drive for 30 seconds, and then continuously at 50% of rated current. The level of current is adjustable from 10% to 136% of the drive controller's constant torque current rating.

DRIVE AND MOTOR CONFIGURATION PARAMETERS

Drive and motor configuration parameters can be viewed and modified only when the access locking switch on the keypad display is in the total unlock position (see page 24). These parameters can be modified only when the motor is stopped.

Input Frequency

The controller is equipped with a two-position switch, which is used to select 50 or 60 Hz input frequency.

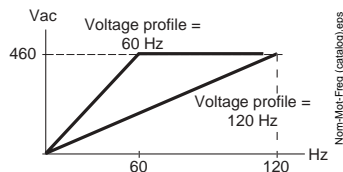
Nominal Motor Voltage

This parameter is used to enter the nominal motor voltage given on the motor nameplate.

The factory setting is 230 Vac with a range of 200 to 240 Vac for the ATV58•M2 models. For the ATV58•N4 models, when the input frequency switch is set to 60 Hz, the factory setting is 460 Vac with a range of 200 to 500 Vac; when the switch is set to 50 Hz, the nominal motor voltage defaults to 400 Vac with a range of 200 to 500 Vac.

Nominal Motor Frequency

This parameter is used to enter the nominal motor frequency given on the motor nameplate. The factory setting is 60 Hz when the input frequency switch is set to 60 Hz. When the switch is set to 50 Hz, the nominal motor frequency defaults to 50 Hz. The range is 10 to 500 Hz. The nominal motor frequency setting defines the frequency at which nominal motor voltage is applied to the motor. The parameter cannot be set above the maximum output frequency setting.



Nominal Motor Current

This parameter is used to enter the nominal motor current given on the motor nameplate. The factory setting is 90% of the drive controller's constant torque current rating. The range for this parameter is 25% to 136% of the constant torque current rating.

Nominal Motor Speed (rpm)

This parameter is used to enter the nominal motor speed (rpm) given on the motor nameplate. The factory setting depends on the drive controller setting. The range for this parameter is 0 to 9999. This value should correspond to the full load RPM (that is, this value should incorporate slip).

Motor Power Factor

This parameter is used to enter the motor power factor given on the motor nameplate. This allows the drive to provide better current regulation for better motor torque performance. The factory setting depends on the drive controller rating. The range for this parameter is 0.5 to 1.

Auto Tune

This parameter causes the drive controller to auto tune the connected motor. When Auto Tune is initiated, the drive controller allows a pulse of current to pass to the connected motor, and measures and stores motor stator resistance and conductor resistance. This allows the drive to provide better current regulation for improved motor torque performance. Auto Tune can be initiated from the keypad, by a logic input assigned to this function, or over a serial communication link.

Automatic Adaptation of the Deceleration Ramp

This function provides automatic adaptation of the deceleration ramp if the programmed ramp setting is too low for the inertia of the load. This prevents possible faulting of the drive controller due to excessive braking. All applications, except those requiring precise stopping and those which use braking resistors, may benefit from this function.

The setting of this function is either Yes or No, with the default setting determined by the macro-configuration. Automatic adaptation must be cancelled if the machine has position control with stopping on a ramp and a braking resistor installed. If a braking sequence is configured, this function is automatically disabled.

Alternate Ramp Switching using Frequency Threshold

Alternate ramp switching allows switching between two sets of acceleration and deceleration ramp times, with each set being adjusted separately. To switch between the two sets, a frequency threshold can be defined. (A logic input may also be configured for ramp switching; see page 53.)

Ramp switching is particularly suited for the following:

- Material handling applications that require smooth starting and approach.
- Applications involving fast, steady-state speed correction.
- High-speed lathes with limitation of acceleration and deceleration above certain speeds.

Altivar® 58 TRX AC Drives

Drive and Motor Configuration Parameters

Acceleration and Deceleration Ramp Profile

The ramp profile for acceleration and deceleration is the gradual change of the output frequency from a speed reference following a linear or predetermined ratio that enables the ramps to be given an S- or U-shaped profile. For the ATV58 TRX controller, the selection of a ramp profile (linear, S, or U) affects both the acceleration and deceleration ramps.

An S-shaped ramp profile takes up mechanical play, eliminates jolts, and limits “non-following” of speed during rapid transient operation of high-inertia machines. They are particularly suited to applications involving materials handling, packaging, and personnel transportation.

U-shaped ramp profiles are ideal for pumping applications (installations with centrifugal pumps and non-return valves) because they improve control over valve operation.

The table below provides graphical representations of these two ramp profiles.

S-Shaped Ramp Profile	U-Shaped Ramp Profile
The curve coefficient is fixed, with $t_2 = t_1 \times 0.6$ (t_1 is the set ramp time).	The curve coefficient is fixed, with $t_2 = t_1 \times 0.5$ (t_1 is the set ramp time)

Torque Limit

A torque limit can be implemented in three ways on constant torque rated products:

- With the Torque Limit parameter. This parameter is factory set at 200% and can be adjusted from 0 to 200% of the drive controller's constant torque rating.
- With a logic input and an associated torque limit (see Torque Limit by Logic Input).
- With an Analog Input (see Torque Limit by Analog Input).

Current Limit

This parameter can be used to limit the maximum motor current. This parameter is factory set at 136%, and can be adjusted from 25% to 136% of the drive controller's constant-torque output current rating.

Switching Frequency

This function allows configuration of the drive output transistors' switching frequencies. Refer to the drive controller rating table for continuous current ratings and associated switching frequency. The table below shows the available switching frequencies by type (parameter SFt) for each ATV58 TRX model.

Configurable Switching Frequencies

ATV58 TRX Models	LF Type (kHz)	HF1, HF2 Type (kHz)
ATV58•U09M2 to ATV58•D12M2 ATV58•U18N4 to ATV58•D23N4	0.5, 1, 2, 4	8, 12, 16
ATV58HD16M2X and ATV58HD23M2X ATV58HD28N4 to ATV58HD46N4	0.5, 1, 2, 4	8, 12
ATV58HD28M2X to ATV58HD46M2X ATV58HD54N4 to ATV58HD79N4	0.5, 1, 2, 4	8
ATV58HC10N4X to ATV58HC33N4X	0.5, 1, 2	4

ATV58 TRX drive controllers have an automatic feature that is used if the drive controller is intermittently used at the high end of its temperature rating and HF1 or HF2 switching frequency type is programmed. In this configuration, if the drive controller thermal state goes above 95%, the switching frequency drops into the LF: Low Freq. type range of 2 or 4 kHz depending on the drive controller rating (see the table above). When the thermal state cools to 70%, the switching frequency returns to the set value.

Altivar® 58 TRX AC Drives Drive and Motor Configuration Parameters

A higher switching frequency will produce a waveform with less harmonic distortion and allow the current regulator in the drive controller to perform better. Cable lengths greater than 330 feet (100 m) may require adjusting the switching frequency to lower settings to reduce the transmission line phenomena that tends to develop in long conductors.

Motor Noise Reduction

When this parameter is enabled, the switching frequency is randomly modulated to avoid audible resonance from the motor. This parameter is useful in applications where audible motor noise is undesirable.

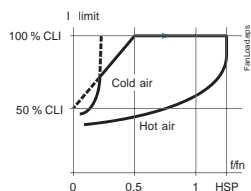
Energy Economizer

This function is enabled when the Variable Torque macro-configuration is selected. When this parameter is enabled, the drive controller optimizes the motor efficiency by automatically adjusting the volts/hertz ratio. The drive controller accelerates the load with a constant volts/hertz ratio. When the reference speed is attained, the drive controller begins lowering the voltage applied until the current begins to rise. It operates at this point until the speed reference is changed. This parameter is useful for saving energy in all variable torque applications.

Volts/Hertz Adjustment

This function is available in variable torque mode and if the Energy Economizer function is disabled. This parameter is useful in applications where the user wishes to define the volts/hertz profile manually instead of having the drive controller perform this function with the Energy Economizer function.

The factory default is set to 20%, with an adjustment range of 0 to 100%.



**Current Limit
Adaptation Curves**

Current Limit Adaptation

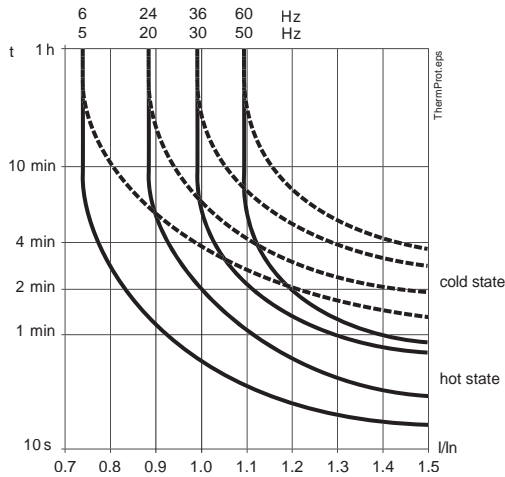
This function is available in variable torque mode, and provides for the automatic adaptation of the current limit according to the speed to avoid a motor overload fault. It is used in applications involving fans where the load curve of the fan changes with the air density, as shown in the graph to the left.

Special Motor Adaptation

This parameter should be enabled when using special motors such as synchronous permanent magnet motors, synchronous wound field motors, or synchronous reluctance motors. This parameter should also be enabled when one drive is used to control multiple motors in parallel. See the Thermal Protection of Motor below for more information. Enabling this parameter increases the IR compensation adjustment range from 0 to 800%. This parameter can also be used in testing when a very small motor is used only to verify proper operation of a drive system wiring and control.

Altivar® 58 TRX AC Drives

Drive and Motor Configuration Parameters



Thermal Protection Tripping Curves

Thermal Protection of Motor

This function provides indirect thermal protection of the motor by continuous calculation of its theoretical temperature rise. The drive controller will fault if the calculated temperature rise exceeds 118% of the nominal temperature rise.

For applications using self-cooled or force-cooled motors, the microprocessor calculates the theoretical temperature rise of the motor using the following elements:

- Operating frequency.
- Current drawn by the motor.
- Operating time.
- Maximum ambient temperature of 40 °C (104 °F) around the motor.

The following adjustments may be made:

- 0.25 to 1.36 times the nominal current of the drive controller's constant-torque rating, preset at 0.9.
- Adjust to the nominal current indicated on the motor rating plate.

NOTE: When the drive controller de-energizes, the I^2t calculation is saved and the cooling effect is calculated.

This function may also be used for specialized applications. Thermal protection may be customized in the fault configuration menu for:

- Applications with force-cooled motors. See the tripping curves at left for the nominal frequency 50/60 Hz.
- Inhibiting thermal protection in harsh environments where temperatures exceed 40 °C (104 °F) around the motor or where there is a risk of the cooling fins becoming clogged. In these applications, provide direct thermal protection using PTC thermistor probes built into the motor.
- Protection of motor using PTC probes. See "Thermal Protection with PTC Probes" below.
- In the case of motors connected in parallel on the same controller, each motor starter must be fitted with a thermal overload relay.

Thermal Protection with PTC Probes

This function provides thermal protection of the motor. The function must be assigned to analog input AI3 on the I/O Extension Card with Analog Inputs and the motor must be equipped with PTC probes.

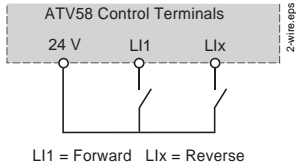
The maximum resistance of the probe circuit at 20 °C (68 °F) is 750 Ω (3 x 250 Ω probes in series). The probe break and probe short-circuit faults are monitored.

Thermal Protection of ATV58 TRX Controller

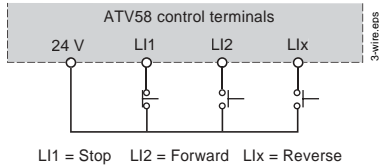
This function provides direct thermal protection via a thermistor affixed to the heatsink, thus ensuring component protection even in the case of faulty ventilation or excessive ambient temperature. When an overtemperature condition is sensed, the controller will fault on drive overtemperature.

DRIVE CONTROL PARAMETERS

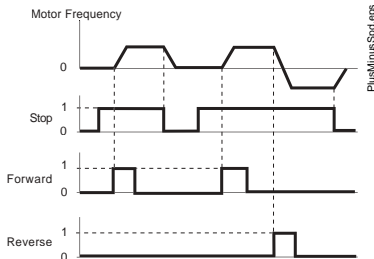
Drive control parameters can be viewed and modified only when the access locking switch on the keypad display is in the total unlock position (see page 24). They can be modified only when the motor is stopped.



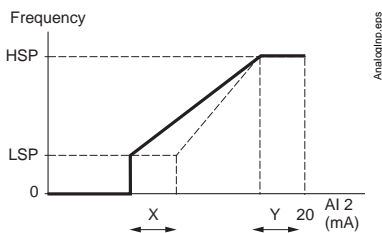
Two Wire Control



Three Wire Control



Three Wire Control Timing Diagram



Analog Input 2 Scaling

Two-Wire Control

The drive controller is factory-configured for two-wire control. The two-wire control function controls operation direction using maintained contacts. Depending on whether one or two directions of operation are required by the application, one or two logic inputs must be assigned to this function. An example of wiring for two-wire control is shown to the left. Three operating modes are possible:

- Detection of the state of logic inputs.
- Detection of a change in the state of logic inputs.
- Detection of the state of logic inputs with Forward operation having priority over Reverse operation.

Three-Wire Control

The three-wire control function controls operation and stopping direction using momentary contacts. Depending on whether one or two directions of operation are required by the application, two or three logic inputs must be assigned to this function. An example of wiring for three-wire control is shown to the left. Three-wire control is appropriate for all types of applications with one or two operating directions.

Reverse Inhibit

This function disables reverse operation. It disables the REV key on the keypad display and also prohibits reverse operation commanded by the PI Regulator or Speed Reference Summation functions. Applications such as those involving pumps, fans, or other applications where reverse operation may cause mechanical damage may require reverse to be disabled.

Analog Input Configuration

This parameter allows Analog Input 2 (AI2) on the drive controller to be redefined to accept a range of signals. The input can be configured for 0 to 20 mA, 4 to 20 mA, or the minimum value (X) and maximum value (Y) can be user assigned by programming X and Y (with 0.1 mA resolution). Reverse-acting operation can also be configured. For example, 20 to 4 mA, where 20 mA equals low speed and 4mA equals high speed.

Keypad Command

When this parameter is set to Yes, the drive controller can be controlled by the keypad. The factory default is No. Enabling this parameter allows operation of the drive controller with the keypad RUN, STOP/RESET, and FWD/REV keys. In this mode of operation, the speed reference is entered in hertz or in customer defined units by using the keypad up or down arrow keys. Also, a logic input configured for Freewheel Stop, Fast Stop, or Stop by DC Injection will remain active at the control terminal strip.

Stop Priority

This parameter allows the keypad STOP key to remain active even if the drive is being commanded via the terminal strip or a serial connection. The factory default is Yes. If set to No, the keypad STOP key will not be active and the drive controller will not stop when it is pressed.

Altivar® 58 TRX AC Drives

Configurable I/O Functions

Drive Address

This parameter is used to set the address when controlling the drive controller by a Modbus device via the RS-485 port. The baud rate is selectable as 9600 or 19,200 bits/sec. The range of addresses is 0 to 31. The factory setting is 0, indicating that the drive controller is not being controlled via the RS-485 port.

Reset Counters

This parameter can be used to reset the watt-hour meter or the run time meter back to zero.

CONFIGURABLE I/O FUNCTIONS

Configurable I/O Functions can be viewed and modified only when the access locking switch on the keypad display is in the total unlock position (see page 24). These parameters can be modified only when the motor is stopped.

Default I/O Configurations

Selecting a macro-configuration automatically assigns the inputs and outputs to functions suitable for the application. The table below shows the drive controller I/O assignment as a function of the macro-configuration selected.

Factory-Configured Functions for the Three Macro-Configurations

	Material Handling ^[1]	General Use	Variable Torque
Basic I/O			
Logic input LI1	Forward	Forward	Forward
Logic input LI2	Reverse	Reverse	Reverse
Logic input LI3	2 preset speeds	Jog operation	Auto-Manual ^[3]
Logic input LI4	4 preset speeds	Freewheel stop/Run permissive ^[2]	DC injection braking ^[3]
Analog input AI1	Reference summing	Reference summing	Speed reference 1 ^[3]
Analog input AI2	Reference summing	Reference summing	Speed reference 2 ^[3]
Analog output AO1	Motor frequency	Motor frequency	Motor frequency
Relay R1	Drive fault relay	Drive fault relay	Drive fault relay
Relay R2	Output contactor control	Motor thermal state attained	Frequency reference attained ^[3]
Analog or Digital I/O Extension Cards			
Logic input LI5	8 preset speeds	Fault reset	Freewheel stop
Logic input LI6	Fault reset	Current limit	Ramp switching
Analog input AI3 (analog I/O card) or Encoder Inputs (digital I/O card)	Summing speed reference	Summing speed reference	PI regulator
	Speed regulation	Speed regulation	Speed regulation
Logic output LO	Current threshold attained	Output contactor control	High speed attained
Analog output AO	Motor current	Motor current	Motor current

[1] Factory default setting for 100 hp products and below.

[2] If the Freewheel Stop/Run Permissive function is configured, the drive controller will not start the motor unless the logic input is connected to +24 V.

[3] For 125–500 hp controllers, the factory settings are:

LI3 = fault reset; LI4 = Not assigned; AI1 = Reference summing; AI2 = Reference summing; R2 = Drive running.

Assignable I/O Functions

The table below shows the possible I/O assignments for the ATV58 TRX Type H drive controller and the optional I/O Extension Cards. Only one I/O extension card or one communication card can be installed in the drive.

The following I/O are on the drive controller.

- Logic Input 1 (LI1) is configured for Run Forward when the drive controller is set for two wire control and configured for STOP when the drive controller is set for three wire control.
- Relay Output 1 (R1) is configured as a fault relay (1 N.O. contact and 1 N.C. contact) and cannot be re-assigned.

Altivar® 58 TRX AC Drives Configurable I/O Functions

- Analog Input 1 (AI1) is configured for 0 to 10 Vdc speed reference input. It is factory-configured to sum with other analog inputs. AI1 is designated as Speed Reference 1 when Reference Switching (Hand Auto mode) is configured. AI1 is designated as Set Point Reference when the PI regulator function is configured.

Possible Assignments	Assignable I/O on the ATV58 TRX Controller				Assignable I/O with Optional I/O Extension Card							
					Analog I/O Extension Card				Digital I/O Extension Card			
	AI2	LI2 LI3 LI4	R2	AO	LI5 LI6	LO	AO	AI3	LI5 LI6	LO	AO	A+ A- B+ B-
Reverse Operation												
Ramp Switching												
Jog Operation												
+/- Speed												
Setpoint Memory												
Preset Speeds												
Freewheel Stop												
Fast Stop												
DC Injection Braking												
Motor Switching												
Second Torque Limit												
Forced Local												
Fault Reset												
Reference Switching												
Auto Tune												
PI Auto/Manual												
PI Preset Setpoints												
External Faults												
Torque Limit Switching												
Summing Reference												
PI Regulator Feedback												
PI Manual Speed Reference												
Second Speed Reference												
Speed Feedback												
PTC Motor Probes												
Torque Limit (Analog)												
Drive Running												
Output Contactor Control												
Reference Speed Attained												
High Speed Attained												
Frequency Level Attained												
Current Level Attained												
Motor Thermal Level Attained												
Drive Thermal Level Attained												
Loss of Follower (4–20 mA)												
Frequency Level 2 Attained												
Brake Sequence												
Motor Current												
Motor Frequency												
Ramp Output												
Motor Torque												
Signed Motor Torque												
Signed Ramp												
PI Reference												
PI Feedback												
PI Error												
PI Integral												
Motor Power												
Motor Thermal												
Drive Thermal												

FUNCTION COMPATIBILITY

The table below shows the I/O functions that are not compatible with each other. Any function not listed in this table is compatible with all other functions.

Aside from the particular functions shown in this table, two general priorities exist:

- Stop functions always have priority over Run commands.
- Speed references via logic command always have priority over analog setpoints.

In addition, the choice of functions is limited by:

- The number of controller inputs and outputs to be re-assigned.
- The incompatibility of certain functions with others.

	Automatic DC injection braking	Summing inputs	PI Regulator	+Speed/-Speed	Reference switching (Auto/manual)	PI regulator with Auto/manual	Freewheel stop	Fast stop	Jog	Preset Speeds	Reverse operation	Inhibit reverse operation	Speed regulation with tachogenerator or encoder	Torque limitation via AI3	Torque limitation via LI
Automatic DC injection braking							↑								
Summing inputs					●	●									
PI Regulator					●				●	●			●		
+Speed/-Speed					●	●			↑	●					
Reference switching (Auto/manual)		●	●	●		●				●					
PI regulator with Auto/manual		●		●	●										
Freewheel stop	←							←							
Fast stop							↑								
Jog			●	←						←					
Preset Speeds			●	●	●				↑						
Reverse operation												●			
Inhibit reverse operation											●				
Speed regulation with tachogenerator or encoder			●											●	
Torque limitation via AI3														●	
Torque limitation via LI															

Compatibility Table-add (catalog) .eps

- Incompatible functions
- Compatible functions
- No significance

Function priority (functions which cannot be active at the same time):

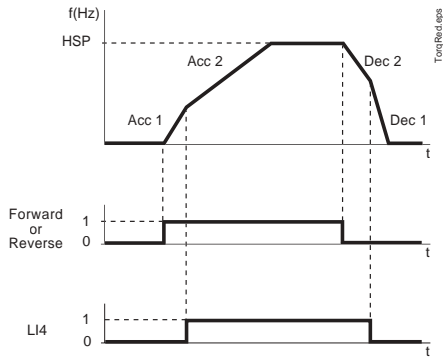
- ← ↑ The arrow points to the function that has priority.

The stop functions have priority over run commands.
The speed references from a logic command have priority over analog references.

*Note: An incompatible function must be deselected before the desired function can be programmed.
For example, if preset speeds is programmed, it must be cleared before the +/- speed parameter can be selected.*

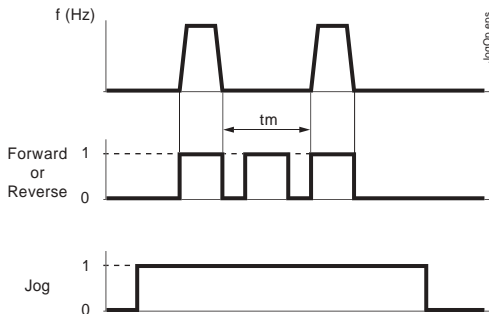
ASSIGNMENT OF LOGIC INPUTS (LIx)

The following sections describe the possible assignments of the Logic Inputs (LIx) on the drive controller and the optional I/O Extension Cards. Logic Input 1 (LI1) is configured for Run Forward when the drive controller is set for two wire control and configured for STOP when the drive controller is set for three wire control. In three wire control, Run Forward requires a logic input. Run Reverse, if used, requires another logic input.

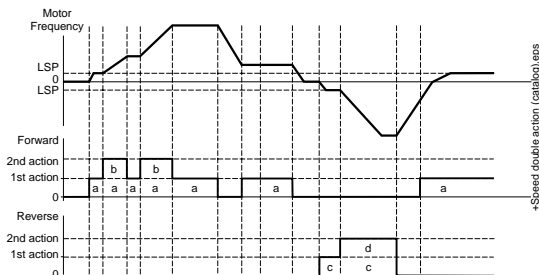


Acceleration 1/Deceleration 1: Adjustment 0.05 to 999.9 s, preset at 3 s
Acceleration 2/Deceleration 2: Adjustment 0.05 to 999.9 s, preset at 5 s

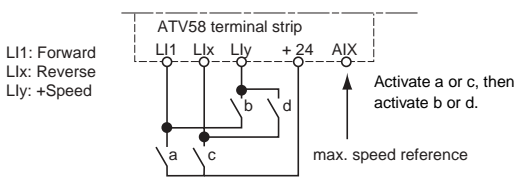
Ramp Switching Timing Diagram



Jog Speed Timing Diagram



+ Speed Timing Diagram



+ Speed Wiring Example

Reverse Operation

A logic input is assigned to reverse the direction of operation. The factory default is for logic input LI2 to be used to reverse operation. To disable this function (for example, when using the controller with a single-direction motor), configure for no assignment or re-assign LI2 to another function.

Alternate Ramp Switching

Alternate ramp switching allows switching between two sets of acceleration and deceleration ramp times, with each set being adjusted separately. A logic input can be assigned to switch between the two sets. A frequency threshold may also be configured for ramp switching; see page 45.

Ramp switching is particularly suited for the following:

- Material handling applications that require smooth starting and approach.
- Applications involving fast, steady-state speed correction.
- High-speed lathes with limitation of acceleration and deceleration above certain speeds.

An example of using a logic input (LI4) to switch between two sets of ramps is shown to the left.

Jog Speed

This function pulses motor operation using minimum ramp times (0.1 s), limited speed, and delay time between two pulses. To use this function, assign a logic input to jog. Jog direction is provided by the operating direction command. This function is particularly appropriate for the following applications:

- Machines requiring some manual operation during the process.
- Gradual advancement of equipment during a maintenance operation.

The graph to the left portrays a typical jogging operation. The speed reference adjusts between 0 and 10 Hz (preset at 10 Hz) and the delay (t_m) between jog pulses adjusts from 0 to 2 s (preset at 0.5 s).

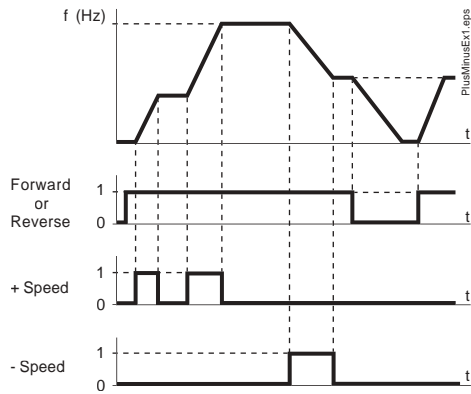
+ Speed

This function is also referred to as the motorized potentiometer function. It allows the speed reference to be increased using one logic signal. The speed is maintained when the + speed input is opened. The maximum speed is given by the reference applied to the analog inputs. For example, connect AI1 to +10 Vdc. To use this function, one or two logic inputs must be re-assigned. This function is appropriate for:

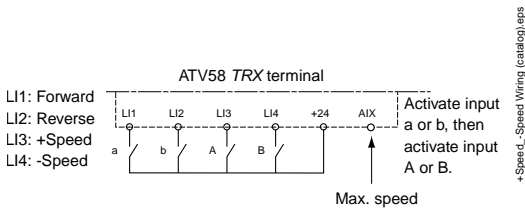
- Applications involving centralized control of a machine composed of several sections operating in one direction.
- Controlling a material handling crane operating in two directions with a pendant control station.

Examples of this function are shown in the illustration to the left.

Altivar® 58 TRX AC Drives Assignment of Logic Inputs (Llx)



**+/- Speed With Saving the Last Reference
Timing Diagram**



+/- Speed Wiring Example

+/- Speed

This function may also be referred to as the motorized potentiometer function. It allows the speed reference to be increased or decreased using one or two logic signals, with or without saving the last reference speed. The maximum speed is given by the reference applied to the analog inputs. For example, connect AI1 to +10 Vdc. To use this function, two or three logic inputs must be re-assigned.

This function is appropriate for:

- Applications involving centralized control of a machine composed of several sections operating in one direction.
- Controlling a material handling crane operating in two directions with a pendant control station.

Two examples of this function are shown at the left.

Setpoint Memory

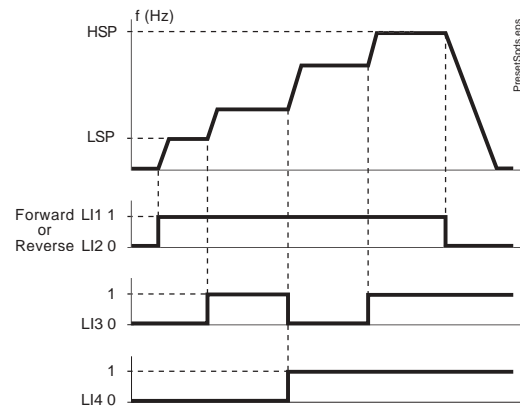
This function is associated with the +/- Speed function, and determines whether the speed reference level is read and stored upon loss of the Run signal or the mains supply. The stored reference is applied to the next Run signal. The function may be set to either Yes (store reference signal) or No (do not store reference signal).

Preset Speeds

The Preset Speeds function allows switching between 2, 4, or 8 preset speeds, and requires 1, 2, or 3 logic inputs respectively. The function is typically used with materials handling and machines with several operating speeds. A typical example involving four speeds is shown to the left.

In this example, four speeds are obtained with inputs LI3 and LI4. At state 0, the speed is LSP or the speed reference depending on the level of analog inputs AI1 and AI2. The preset speeds may be adjusted from 0.1 Hz to the maximum frequency. The factory default settings are:

- 1st Speed: LSP or reference.
- 2nd Speed: 5 Hz.
- 3rd Speed: 10 Hz.
- 4th Speed: HSP

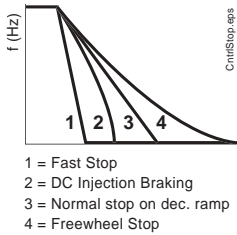


Preset Speeds Timing Diagram

Preset Speed Logic

2 Preset Speeds		4 Preset Speeds			8 Preset Speeds			
Assign Llx to PS2.		Assign Llx to PS2, then Lly to PS4.			Assign Llx to PS2, then Lly to PS4, then Liz to PS8.			
Llx	Speed reference	Lly	Llx	Speed reference	Liz	Lly	Llx	Speed reference
0	LSP + AI reference	0	0	LSP + AI reference	0	0	0	LSP + AI reference
1	HSP	0	1	SP2	0	0	1	SP2
		1	0	SP3	0	1	0	SP3
		1	1	HSP	0	1	1	SP4
		1	0	SP5	1	0	0	SP5
		1	0	SP6	1	0	1	SP6
		1	1	SP7	1	1	0	SP7
		1	1	HSP	1	1	1	HSP

NOTE: To reassign the logic inputs to a function other than Preset Speeds, PS8 (Liz) must be cleared, then PS4 (Lly), then PS2 (Llx).



Controlled Stop Diagram

Controlled Stop Functions

The Controlled Stop functions provide alternate stopping methods to the normal drive controller stop. Normally, the drive controller follows the deceleration ramp on a command to stop. To use the Controlled Stop function, one logic input (LI) must be assigned. The input is active at state 0 (open) for a Freewheel Stop or Fast Stop, and is active at state 1 (closed) for DC Injection Braking. These stop requests always have priority over a normal stop or a Run signal. Three controlled stop methods are available:

- **Freewheel Stop/Run Permissive**

The drive controller output is turned off and the motor coasts to a stop according to the inertia and resistive torque of the load. This method is often used in applications where Run Permissive is used as an electrical safety device.

- **Fast Stop**

Braking with deceleration ramp time divided by a coefficient adjustable from 1 to 10. This method is often used for materials handling applications and provides the quickest way to stop without additional hardware.

- **DC Injection Braking**

Adjustment of time (0 to 30 s, preset at 0.5 s) and current (10% to 136% of nominal controller current in a high-torque application, preset at 70%). It is possible to set continuous braking current from 10% to 100% of nominal motor current (factory setting is 50%). After 30 s, the current automatically goes to 50%. This method is often used for applications involving fans since it eliminates the need for the addition of a braking resistor.

Note that after a stop (frequency less than 0.1 Hz), DC Injection Braking may be combined with the other methods. For this situation, only the current injected after 30 s can be adjusted.

Switching Between Two Motors

This function allows a single drive controller to control two motors with different power ratings, one at a time. Activating this parameter automatically scales the DC injection current, brake release current, and nominal motor current based on a programmable scaling factor and the larger motor parameters that have been configured. This function inhibits motor thermal protection of the second motor. External contactor control for both motors and external motor thermal protection for the second motor is required for using this function.

Freewheel Stop Below Selectable Frequency

This parameter allows the drive controller to freewheel stop below a programmable frequency. After a stop command is received and the drive has followed the deceleration ramp to the programmed frequency, the drive controller output is turned off and the motor coasts to a stop according to the inertia and resistive torque of the load.

Torque Limit by Logic Input (Constant Torque Rated Products)

This function allows a logic input to be assigned a second level of torque limit. The associated torque level is factory set at 200% and is adjustable from 0-200% of the drive controller constant torque rating. When the assigned logic input is closed (set to state 1) the maximum torque is limited to the configured value. This feature can be used in the following type of applications:

- At the end of a material handling cycle when it may be useful to stall the motor as the load meets a barrier.
- Cut-to-length applications with the material stopped while maintaining some motor torque to hold the material.

Altivar® 58 TRX AC Drives

Assignment of Logic Inputs (Llx)

Forced Local

This function allows a logic input to be assigned to force local control of the drive controller. Configuration of this function is recommended when using serial communication with the drive controller. This input is typically wired into the Hand and Off positions of a Hand-Off-Auto selector switch when used in conjunction with serial communication with the drive controller. Assigning this parameter provides terminal block control when the logic input is closed (state 1). Initiating this input overrides any commands being received over the serial communications link and the drive controller responds to the inputs given at the control terminal block. Parameter data can still be monitored over the serial communication link.

Fault Reset

This function allows faults to be reset by a logic input assigned to this function. Two types of reset are available. See page 66 for fault reset types.

External Fault

This function allows a logic input to be assigned to receive an external contact closure to stop the drive controller and motor. The drive controller will stop according to the controlled stop configuration. This function is useful in applications where interlocking of various equipment and the drive controller is required.

Reference Switching (Auto – Manual)

The Reference switching function permits switching between two analog references by logic command. This function avoids switching of low-level speed reference signals by other means, and enables the two reference inputs A11 and A12 to be independent. To use this function, one logic input (LI) must be re-assigned.

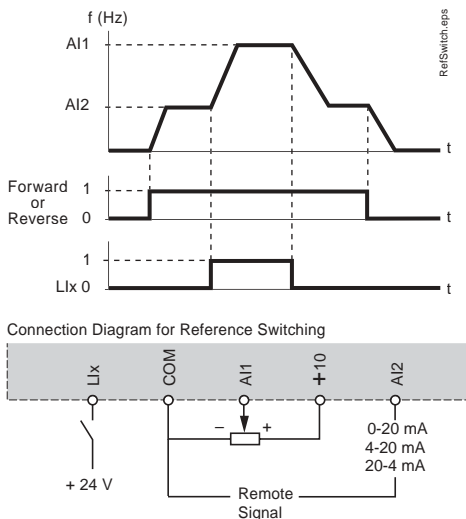
This function is typically used for:

- Machines with automatic/manual operation such as pumps
- Automatic control via a sensor on input A12, validated by the logic input at state 0
- Manual control via potentiometer on input A11 (local control)

A graphical representation of reference switching and a connection diagram are shown to the left.

Auto Tune

This parameter causes the drive controller to auto tune the connected motor. When Auto Tune is initiated, the drive controller pulses the connected motor, and measures and stores motor stator resistance and conductor resistance. This allows the drive to provide better current regulation for improved motor torque performance. Auto Tune can be initiated from the keypad or by a logic input assigned to this function. If an output contactor is used, it is necessary to close the contactor before the auto tune function is initiated.



Reference Switching Timing and Wiring Diagrams

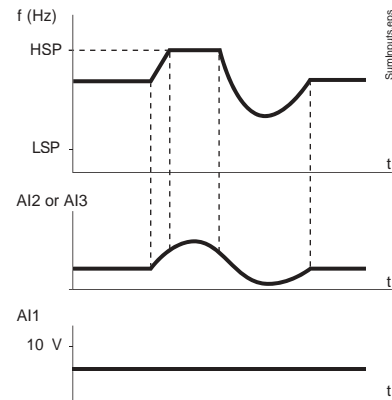
ASSIGNMENT OF ANALOG INPUTS (AIX)

The following sections describe the possible assignments of the Analog Inputs (AIx) on the drive controller and the optional I/O Extension Cards.

Speed Reference Summing

Analog input AI2 (and/or analog input AI3 with an I/O extension card) can be assigned as a summing input for AI1 with peak limiting corresponding to the speed HSP. This is often used for machines whose speed is controlled by a correction signal on input AI2.

The figure to the left provides a graphical depiction of summed references.



Speed Reference Summing Diagram

PI Regulation

The PI Regulation function provides simple regulation of flow rate or pressure with a setpoint input and a sensor sending a feedback signal to the drive controller. This function is often used for pumping and fan applications. Note that the PI Regulation function is not compatible with the Preset Speeds and Jog functions.

The acceleration (ACC) and deceleration (dEC) ramps default to linear ramp type even if the ramps had been configured for S ramp or U ramp.

PI regulator can be used with a logic input configured for PI Auto/Manual mode of operation when the analog option card is used. When the PI regulator is configured and a logic input is configured for PI Auto/Manual, the PI regulator function is active in Auto mode and AI3 is used for speed input in Manual mode.

Logic inputs can be used with the PI regulator to command the drive controller to run from the analog reference, run at process maximum, or operate with two other definable preset setpoints. The configurable setpoints can be used to provide two different setpoints for two different processes, or they can be used instead of using AI1 for setpoint input. For example, providing a setpoint via the logic inputs can eliminate the need for a potentiometer.

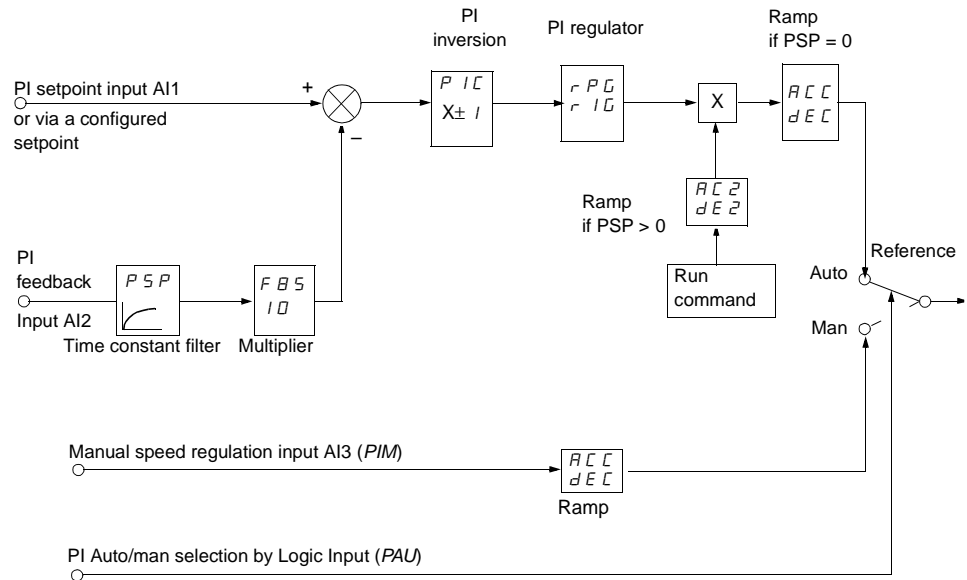
Four analog outputs are available to monitor various aspects of the PI regulator function. See page 63 for more information.

PI Setpoint	OPS	PI Feedback	OPF
PI Error	OPE	PI Integral Error	OPI

Altivar® 58 TRX AC Drives

Assignment of Analog Inputs (AIx)

The following figure shows a diagram of the PI Regulator inputs, calculation points, and outputs.



The following table provides a description of the inputs to the PI Regulator.

Input	Range	Description																														
PI setpoint		The setpoint to the PI regulator can be provided from one of three sources: — via analog input, AI1 (AI2 and AI3 can be set to sum with AI1) — via preset setpoints defined by logic inputs (see Preset setpoints in this table) — over a communication network																														
PI feedback		The feedback to the PI regulator can be provided from AI2 (0–20 mA signal) or AI3 (0–10 Vdc voltage signal).																														
Auto / Manual with manual speed Input		When the PI regulator is configured and a logic input is configured for Auto / Manual, AI3 is the speed input in manual mode. The PI regulator function is active in Auto mode. When the logic input is open, (set to state 0), Manual mode is active and the PI regulator is active. Auto mode is active when the logic input is closed, (set to state 1). In manual mode AI3 is enabled and the drive controller responds proportionally to the speed reference at AI3.																														
Preset setpoints	0–100% of process maximum	Logic inputs can also be used to provide programmable setpoints. Two or four preset setpoints require the use of one or two logic inputs respectively. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="2">2 preset setpoints</th> <th colspan="3">4 preset setpoints</th> </tr> <tr> <th>Llx</th> <th>Reference</th> <th>Lly</th> <th>Llx</th> <th>Reference</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Analog reference</td> <td>0</td> <td>0</td> <td>Analog reference</td> </tr> <tr> <td>1</td> <td>Process max. (HSP)</td> <td>0</td> <td>1</td> <td>PI2 (adjustable)</td> </tr> <tr> <td></td> <td></td> <td>1</td> <td>0</td> <td>PI3 (adjustable)</td> </tr> <tr> <td></td> <td></td> <td>1</td> <td>1</td> <td>Process max. (HSP)</td> </tr> </tbody> </table>	2 preset setpoints		4 preset setpoints			Llx	Reference	Lly	Llx	Reference	0	Analog reference	0	0	Analog reference	1	Process max. (HSP)	0	1	PI2 (adjustable)			1	0	PI3 (adjustable)			1	1	Process max. (HSP)
2 preset setpoints		4 preset setpoints																														
Llx	Reference	Lly	Llx	Reference																												
0	Analog reference	0	0	Analog reference																												
1	Process max. (HSP)	0	1	PI2 (adjustable)																												
		1	0	PI3 (adjustable)																												
		1	1	Process max. (HSP)																												
PI Inversion	Yes/No	PI inversion permits an inverted, or reverse-acting, response to the PI setpoint signal. If PIC = No, the motor speed increases when the error is positive. If PIC = Yes, the motor speed decreases when the error is positive.																														
PI proportional gain	0.01–100	PI regulator proportional gain adjusts the scaling of the PI setpoint signal.																														
PI integral gain	0.01–100 s	PI regulator integral gain adjustment.																														
Time-constant feedback filter	0–10 s	PSP can be used to dampen the feedback signal. If PSP is set to zero, the ACC and dEC ramps are active. If PSP is > 0, the AC2/dE2 ramps are active. Adjustment of AC2/dE2 can be used to refine the response of the PI loop. The dEC ramp is used on stopping.																														
PI feedback scaling	1.0–100	PI feedback scaling allows adjustment of the maximum value of the PI feedback signal so that it corresponds to the maximum value of the PI regulator speed reference.																														

NOTE: Unlike the previous assignments, which may be assigned to either the analog or digital I/O extension cards, the following assignments can only be assigned to the A+,A-,B+,B- terminals on the digital I/O extension card.

Encoder Speed Feedback

The Encoder Speed Feedback function can be used to improve the speed regulation based on the encoder feedback signal. It is intended for use in applications in which the load on the motor is changing but accurate speed regulation is critical to the process. The speed feedback input to the drive controller is 24 Vdc. A choice of two different types of encoders can be configured as speed feedback: a NPN sensor type, or a quadrature type encoder.

The NPN sensor type is for use in applications in which the sensor is detecting teeth on a wheel. The 24 Vdc supply on the option card can be used to power the NPN sensor. The quadrature encoders are usually mounted to the motor shaft. An external 24 Vdc power supply for the encoder is recommended. Selection of the encoder is critical for obtaining desired speed regulation.

The NPN sensor type encoders can improve the speed regulation from ± 1% to ± 0.5% of motor rated speed. The quadrature type encoder can improve the speed regulation to ± 0.02% of rated motor speed with a 1024 pulse count encoder.

The maximum signal frequency input with this option card is 33 kHz. Higher pulse count encoders provide greater accuracy. The pulse count must be configured in the drive controller. Use the following to assist in selecting an encoder.

1. Determine the maximum allowable pulse count (pulses per revolution, line count, encoder resolution) with the following formula.

$$\text{Max. allowable pulse count} = \frac{33,000 (\text{max. signal frequency}) \times 60 (\text{seconds/minute})}{\text{Motor RPM @ drive controller maximum frequency}}$$

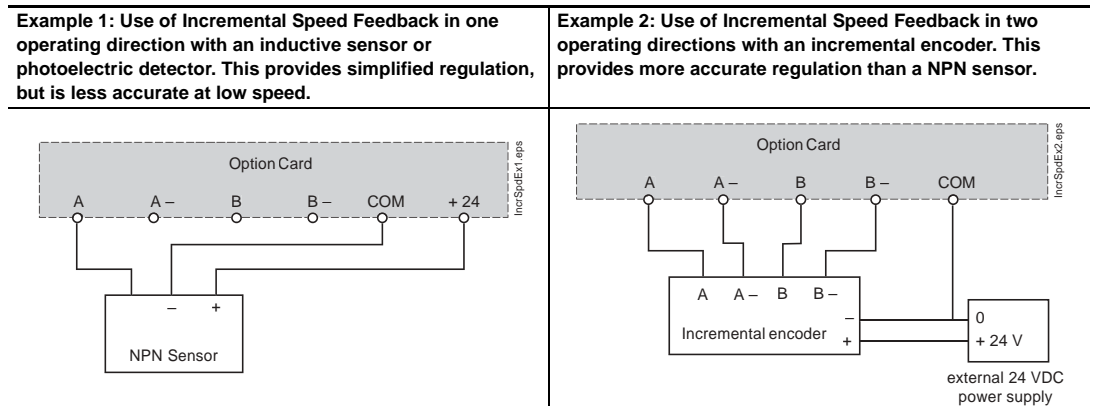
2. When selecting an incremental encoder: use an encoder with a pulse count closest to, but not greater than, the result of the calculation in step 1. This will result in the highest precision.
3. When selecting a NPN sensor, choose a device that will limit the pulse count to the value determined in step 1. Mechanical play in the toothed wheel or other device will degrade the resulting precision.
4. The maximum pulse frequency of the sensor must not be exceeded. Generally, it is this parameter that limits precision. As an example, the pulse count of a sensor with a maximum frequency of 2000 Hz on a motor with a top speed of 1800 RPM is:

$$66 \text{ Pulses per revolution} = \frac{2000 (\text{max. signal frequency}) \times 60 (\text{seconds/minute})}{1800 (\text{Motor RPM @ drive controller maximum frequency})}$$

Example

- Motor nominal RPM = 1800 @ 60 Hz.
- Drive controller maximum frequency = 63 Hz.
- Motor nominal RPM @ 63 Hz = 1800 x (63/60) = 1890
- Maximum pulse count = 33,000 x 60 / 1890 = 1047
- Any pulse count of 1047 or less will work. The higher the pulse count, the higher the feedback resolution. The nearest standard encoder pulse count less than the above calculation is 1024.

Examples of the speed feedback function are shown below.



Altivar® 58 TRX AC Drives

Assignment of Analog Inputs (AIx) With Analog I/O Extension Card

Incremental Speed Reference

This function assigns encoder inputs used for the Encoder Speed Function to the “summing input” function. It is useful for the following applications requiring speed synchronization of several motors.

ASSIGNMENT OF ANALOG INPUTS (AIx) WITH ANALOG I/O EXTENSION CARD

The following is a description of the possible assignments of the Analog Inputs (AIx) when the optional Analog I/O Extension Card is added to the ATV58 TRX drive controller.

Tachometer Speed Feedback

The Tachogenerator Speed Feedback function can be used to improve the speed regulation based on the tachometer feedback signal. It is intended for use in applications in which the load on the motor is changing but accurate speed regulation is critical to the process. The tachometer can improve the speed regulation from ±1% to ±0.1% of motor rated speed.

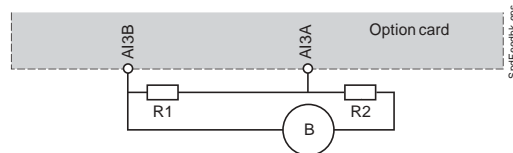
The voltage of the tachogenerator at maximum speed must be between 5 and 9 volts. An accurate setting for adjusting this value can be found in the Adjust menu. If necessary, an external divider bridge may be used to set this value (as shown to the left).

As an example of setting the value, assume a motor is turning at 1500 rpm at 50 Hz, the tachogenerator is 0.06 V/rpm, and the maximum speed is set at 75 Hz (2250 rpm). Then:

- The maximum voltage is $0.06 \times 2250 = 135 \text{ Vdc}$.
- The recommended current for the tachogenerator is 10 mA, so $R1 + R2 = 135/0.01 = 13.5 \text{ k}\Omega$.
- The average voltage on the input is 7 V, thus $R1 = 7/0.01 = 700 \Omega$ or 680Ω (nearest standard value).
- $R2 = 13.5 - R1 = 13.5 - 0.7 = 12.8$ or $12 \text{ k}\Omega$ (nearest standard value).
- Exact voltage on AI3 = $135 \times R1/(R1 + R2) = 135 \times 0.68/12.68 = 7.24 \text{ V}$.

Use resistors with sufficient power (2 W minimum). Exact scaling of speed feedback is to be performed by programming at the time of installation.

Use of a Divider Bridge for Speed Feedback with Tachogenerator

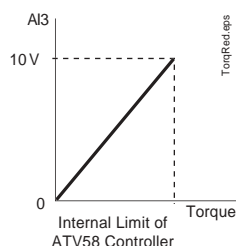


Thermo Temperature Probe (PTC)

See the motor protection section on page 48.

Torque Limit by Analog Input (on Constant Torque Rated Products)

Analog input AI3 may be assigned to this function to allow the amount of torque to be reduced. An I/O extension card with analog input must be installed and a logic input must be assigned to torque limit to use this function. This function is very useful for applications where torque or traction needs to be corrected. The graph below shows how the torque varies as AI3 varies between 0 and 10 Vdc.



If the logic input is at 0, the torque is limited by the setting of the Torque Limit parameter. If the logic input is at 1, the torque is limited by the analog input assigned to this function.

ASSIGNMENT OF LOGIC OUTPUTS (R2 OR LOx)

The following is a description of the possible assignments of the Logic Outputs (R2 or LOx) on the ATV58 TRX drive controller and the optional I/O Extension Cards.

Drive Running

The logic output is high (state 1, 24 Vdc nominal) if the motor is drawing current, or if a run command is generated with a zero speed reference.

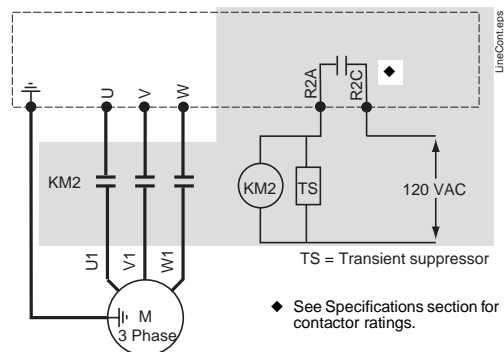
Output Contactor Control

The Output Contactor Control function enables the ATV58 TRX drive controller to control a contactor located between the drive and the motor. The request to close the contactor is made when the Run signal is given. The request to open the contactor is made when the Run signal is removed and the deceleration ramp is completed.

The function is for use in applications where an air gap opening in the motor circuit is required. The connection method illustrated in the diagram below is required.

This function may also be used:

- For applications involving machines where the operation requires power to the motor to be removed when there is a stop to prevent any possibility of an untimely restart (for example, a materials handling carousel where items are put down and then picked up manually).
- To implement a drive controller bypass circuit and to allow across-the-line operation of the motor. The contactor on the drive controller is open in bypass mode to prevent applying line side power to the output of the drive controller.



Wiring Diagram for Output Contactor

Reference Frequency Attained (Speed Attained)

The logic output is high (state 1, 24 Vdc nominal) if the output motor frequency is equal to the speed reference value.

High Speed Attained

The logic output is high (state 1, 24 Vdc nominal) if the output motor frequency is equal to the high-speed value.

Frequency Threshold Attained

The logic output is high (state 1, 24 Vdc nominal) if the output motor frequency is greater than or equal to the configured frequency threshold. The frequency threshold is factory set at 50 or 60 Hz (depending on the position of the 50/60 Hz switch) and has an adjustable range of low speed to high speed. Two different levels can be configured to correspond to two logic output assignments.

Altivar® 58 TRX AC Drives

Assignment of Logic Outputs (R2 or LOx)

Current Level Attained

The logic output is high (state 1, 24 Vdc nominal) if the motor current is greater than or equal to the configured current level. The current level is factory set at 136% and has an adjustable range of 25 to 136% of the drive controller's constant torque rating.

Motor Thermal Level Attained

The logic output is high (state 1, 24 Vdc nominal) if the motor thermal state is greater than or equal to the configured motor thermal level. The motor thermal level is factory set at 100% and has an adjustable range of 0 to 118%.

Drive Thermal Level Attained

The logic output is high (state 1, 24 Vdc nominal) if the drive thermal state is greater than or equal to the configured drive thermal level. The drive thermal level is factory set at 105% and has an adjustable range of 0–118%.

Loss of Follower (4–20 mA Signal)

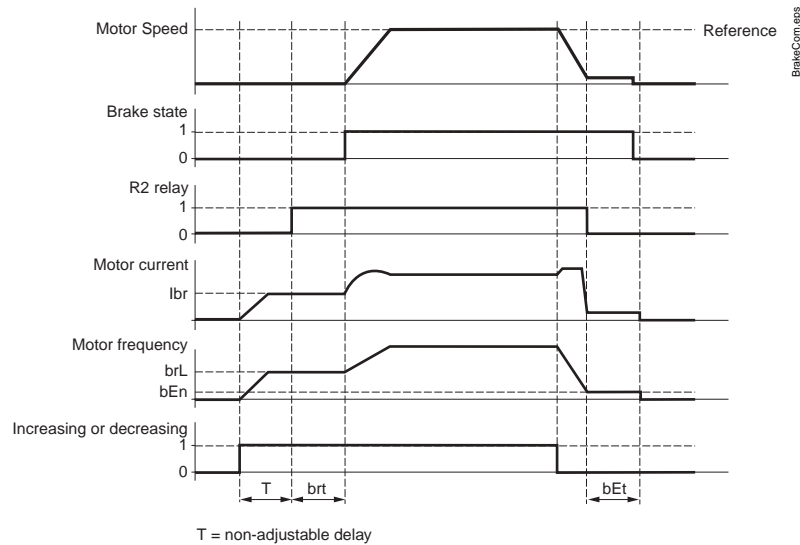
The logic output is high (state 1, 24 Vdc nominal) if the signal on the 4–20 mA speed reference input is less than 2 mA.

Brake Logic Command

This is a set of parameters that allows control of a mechanical brake by the drive controller.

The brake release is determined by brake release frequency, brake release current threshold, and brake release time delay. The brake engage is determined by the brake engage frequency and brake engage time.

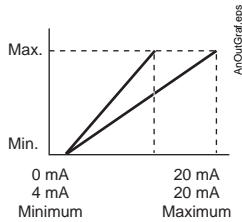
NOTE: Unlike the previous assignments, which may be assigned to either relay R2 or one of the logic outputs (LOx), Brake Logic Command can only be assigned to relay R2.



Parameters accessible in the Adjust menu:

- Brake release frequency (brL).
- Brake release current (I_{br}).
- Brake release time (brt).
- Brake engage frequency (bEn).
- Brake engage time (bEt).

ASSIGNMENT OF ANALOG OUTPUTS (AOx)



Analog Output Ranges

The following sections describe the possible assignments of the Analog Outputs (AOx) on the drive controller and on the optional Extension Cards. The analog output is a current output. The minimum and maximum values are configurable, with a range of 0-20 mA, as shown in the graph to the left.

Motor Current

When configured for motor current, the analog output provides a signal proportional to motor current. The minimum configured value corresponds to zero, while the maximum configured value of the analog output corresponds to 200% of the drive controller's constant-torque rating.

Output Frequency

When configured for output frequency, the analog output provides a signal proportional to motor frequency estimated by the drive controller. The minimum configured value corresponds to zero, while the maximum configured value of the analog output corresponds to the maximum frequency setting, not the high speed setting.

Ramp Output

When configured for ramp output, the analog output provides a signal proportional to the frequency the drive controller is commanding the motor to run. The minimum configured value corresponds to zero, while the maximum configured value of the analog output corresponds to the maximum frequency setting, not the high speed setting.

Motor Torque

When configured for motor torque, the analog output provides a signal proportional to motor torque as an absolute value. The minimum configured value corresponds to zero, while the maximum configured value of the analog output corresponds to 200% of the nominal motor torque.

Signed Motor Torque

When configured for signed motor torque, the analog output provides a signal proportional to motor torque and provides an indication of braking torque or motoring torque. The minimum configured value corresponds to 200% of the braking torque, while the maximum value of the analog output corresponds to 200% of the nominal motor torque. Zero torque corresponds to the average torque value $(\text{minimum value} + \text{maximum value}) / 2$.

Signed Ramp

When configured for signed ramp output, the analog output provides a signal proportional to the frequency the drive controller is commanding the motor to run in the reverse or forward direction. Zero frequency corresponds to:

$$(\text{minimum value} + \text{maximum value}) / 2.$$

The minimum configured value corresponds to the maximum frequency in the reverse direction, while the maximum configured value corresponds to the maximum frequency in the forward direction.

PI Setpoint

When configured for PI setpoint, the analog output provides a signal proportional to the PI setpoint being provided to the drive controller. The minimum configured value corresponds to the minimum setpoint, while the maximum configured value corresponds to the maximum setpoint.

PI Feedback

When configured for PI feedback, the analog output provides a signal proportional to the PI feedback being provided to the drive controller. The minimum configured value corresponds to the minimum feedback, while the maximum configured value corresponds to the maximum feedback.

Altivar® 58 TRX AC Drives

Assignment of Analog Outputs (AOx)

PI Error

When configured for PI error, the analog output provides a signal proportional to the PI regulator error as a percentage of the sensor range being used for the PI feedback, (maximum feedback minus minimum feedback). The minimum configured value corresponds to – 5%, while the maximum configured value corresponds to +5%. Zero corresponds to (minimum value + maximum value) / 2.

PI Integral Error

When configured for PI integral error, the analog output provides a signal proportional to the PI integral error. The minimum configured value corresponds to the low speed setting while the maximum configured value corresponds to the high-speed setting.

Motor Power

When configured for motor power, the analog output provides a signal proportional to power drawn by the motor. The minimum configured value corresponds to 0% of the motor nominal motor power, while the maximum configured value corresponds to 200% of the motor nominal motor power.

Motor Thermal State

When configured for motor thermal state, the analog output provides a signal proportional to the thermal state of the motor calculated by the drive controller. The minimum configured value corresponds to 0% of the motor thermal state, while the maximum configured value corresponds to 200% of the motor thermal state.

Drive Thermal State

When configured for drive thermal state, the analog output provides a signal proportional to the thermal state of the drive controller. The minimum configured value corresponds to 0% of the drive controller thermal state, while the maximum configured value corresponds to 200% of the drive controller thermal state.

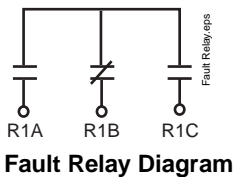
FAULT MANAGEMENT PARAMETERS

The ATV58 TRX drive is equipped with features that are designed to protect the drive controller and motor, and to provide process related information. Understanding the fault management capabilities of the drive controller and determining the proper configuration for the application can enhance the total system installation and performance over the life of the equipment. The fault messages provided by the drive controller can be divided into three categories:

- Protective faults are displayed when the drive detects conditions that may damage the drive controller and/or motor. The drive controller shuts down to prevent further damage from occurring.
- Drive faults are displayed when a problem in the drive needs to be diagnosed.
- Process faults are displayed when a process signal used by the drive controller is interrupted.

Fault Messages

Protective Faults	Drive Faults	Process Faults
Input phase loss	Precharge fault	Loss of 4-20 mA signal
Undervoltage	EEPROM fault	Loss of RS-485
Overvoltage	Internal fault	External fault
Drive overheating	Internal communication fault	Speed feedback fault
Motor overload	Power rating error	Communication network fault
Overbraking	Option error	
Motor phase loss	Option removed	
Overcurrent	EEPROM checks	
Motor short circuit		
Motor overheating		
Thermal sensor fault		
Overspeed		
Ramp not followed		



Fault Relay

The fault relay (R1) provides 1 normally open and 1 normally closed contact. The relay is energized and the state of the contacts reverses when the drive controller is powered up and a fault is not present. This relay cannot be re-assigned.

Resetting a Fault

The drive controller can be reset after a fault by one of three methods:

- Turning power to the drive controller off, wait for the LEDs to go off, and apply power.
- Using the reset button on the keypad, if programmed for local control, or by a logic input assigned to Fault Reset.
- By the Automatic Restart function if configured.

Automatic Restart

This function permits automatic restarting after the drive controller detects a fault, provided that the other operating functions are correct, a Run command is present, and the fault has disappeared. The factory setting for this function is NO. The number of restart attempts and the delay between these attempts is selectable.

When the Auto restart is selected, the fault relay remains energized so that the drive controller does not signal a fault from a condition from which it may be able to restart. If the fault has disappeared, the drive controller will attempt to restart the motor after the delay time configured. The auto restart delay time is factory set at 30 seconds and has an adjustable range of 0.1 to 999.9 seconds. If the drive controller remains faulted after attempting the configured number of restarts, the fault relay will then deenergize. The drive controller must be reset by cycling power after the cause of the fault has been eliminated. The number of restart attempts is factory set at 5 and has an adjustable range of 0 to 255.

Altivar® 58 TRX AC Drives

Fault Management Parameters

The faults which allow automatic restarting are:

- Input mains overvoltage
- 4-20 mA speed reference loss
- External fault
- Serial link fault
- Motor thermal overload if thermal state is below 100%
- Mains voltage too low (for this fault, the function is always active, even if it has not been configured). In the case of this fault, the controller fault relay remains energized if the function is configured, and the speed reference and the operating direction must be maintained.
- Drive controller thermal overload
- DC bus overvoltage
- Motor phase loss

Automatic restart is often used in applications where machines or installations are operating continuously or without supervision and which, when restarted, pose no hazard to either equipment or personnel (for example, pumps, fans, etc.).

Fault Reset Type

This function allows faults to be reset by logic input (Llx), which can be re-assigned to this function. The starting conditions after reset are the same as those at a normal power-up.

Two types of reset are available: Type 1 and Type 2. In Type 1, which is often used for applications where drive controllers are difficult to access (for example, on moving parts in materials handling systems), the following faults may be reset:

- Overvoltage
- External fault
- Motor phase loss
- Loss of 4-20 mA speed reference
- Motor overload if thermal state is below 100%
- Overspeed
- Drive controller overheating
- DC bus overvoltage
- Serial link fault

The mains undervoltage and mains phase loss faults will reset automatically when the supply returns to normal.

In Type 2, all faults are inhibited, including thermal protection functions except motor short-circuit. This type is used in applications involving drive controllers where restart could be vital, such as furnace conveyors, smoke extraction fans, and machines with hardening products which need to be removed.

Output Phase Loss

The output phase loss detection can be disabled. Factory setting is enabled.

Input Phase Loss

The input phase loss detection can be disabled on three phase devices. Factory setting is enabled.

Loss of Follower

The drive controller can be configured to detect a loss of a 4–20 mA speed reference signal. If so configured, the following responses to the loss of signal can be selected:

- Immediate fault, stop the motor
- Stop the motor without fault and restart on return of the reference signal
- Stop the motor, deenergize the fault relay, and display loss of 4–20 mA speed reference on the keypad display
- Continue to run at last the speed without fault and follow the speed reference upon return of the signal
- Continue to run, but at a configured preset speed. The adjustable range for the preset speed is from 0 to the high speed setting.

Automatic Catch of a Spinning Load (Catch-on-the-fly)

This function, also termed a “flying start,” is active by default (although it is automatically disabled if the Brake Sequence function is configured). It allows the motor to be restarted without a speed surge after one of these events:

- Mains power break or simple switch off.
- Fault reset or automatic restart.
- Freewheel stop or DC injection stop with logic input.
- Momentary loss of power downstream of drive controller.

On restart, the controller searches for the effective speed of the motor in order to restart on a ramp from this speed and return to the reference speed. The speed search time can reach 1 s depending on the initial difference.

This function is often used for applications where the motor speed of a machine does not drop rapidly after a mains power break (machines with high inertia) as well as fans and pumps driven by residual flux.

Controlled Stop on Power Loss

This function can be used to determine how the drive controller will react to a loss of power. Three configurations are possible:

- Disabled.
The drive controller immediately faults in response to an input phase loss. This is the factory setting.
- Follow the programmed deceleration ramp until motor stops or undervoltage fault appears.
Use this configuration if a consistent deceleration ramp is more important than maximizing power loss ride through.
- Maintain DC bus voltage.

With this configuration, DC bus voltage is maintained as long as possible. The ATV58 TRX drive is designed to ride through power sags and to provide degraded operation down to 60% of nominal line voltage for 500 ms. Longer ride through is possible if there is sufficient kinetic energy generated by the connected motor load inertia. An undervoltage fault appears after the voltage drops below 60% of nominal line voltage. This configuration should be used to maximize the ride through time of the drive controller and to minimize nuisance tripping.

Altivar® 58 TRX AC Drives

Additional Functionality Provided in the ATV58 Type FVC Drive

ADDITIONAL FUNCTIONALITY PROVIDED IN THE ATV58 TYPE FVC DRIVE

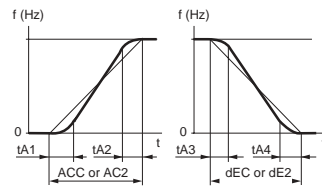
The ATV58 Type FVC drives differ from the ATV58 TRX Type H base product as follows:

- Faster motor control algorithm in open loop and closed loop.
- PID regulator with trim input.
- Motor fluxing options: continuous, by logic input, or on motor starting.
- Ability to customize the shape of acceleration and deceleration ramps.
- Acceleration and deceleration ramp increments selectable as 0.1 or 0.01 seconds.
- Ability to use +/- speed trim around a speed reference input.
- PI mode for applications where initial response time is critical.
- IP mode for applications where suppressing speed overshoot is critical.
- Variable torque macro has been removed. No variable torque ratings.

These functions are described in the following pages.

ATV58 TYPE FVC ADJUSTMENT PARAMETERS

Ability to Shape Acceleration and Deceleration Ramps

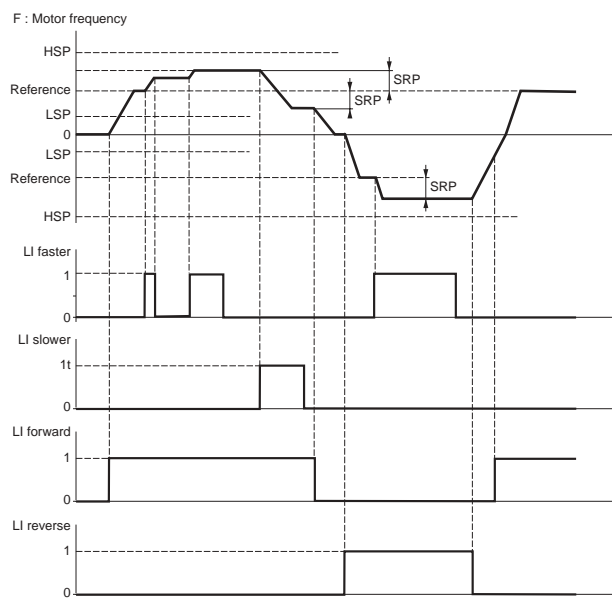


tA1: can be set between 0 and 100% (of ACC or AC2)
 tA2: can be set between 0 and (100% - tA1) (of ACC or AC2)
 tA3: can be set between 0 and 100% (of dEC or dE2)
 tA4: can be set between 0 and (100% - tA3) (of dEC or dE2)
 Parameters tA1, tA2, tA3 and tA4 can be set in the ADJUST menu

custom ramps copy.eps

+ Speed/ - Speed Around a Reference:

- When the run command is given, the motor will reach the speed reference following the acceleration ramp.
- A pulse on + speed or - speed will change the motor speed. The motor will change speed following AC2 or DE2.
- If the Speed reference is changed, the ratio between the speed reference and the speed adjusted by + speed or - speed will be constant. This ratio is limited by the parameter (SRP).
- Adjustments around the setpoint using + speed and - speed are made following the AC2 and dE2 ramps.



+ speed-speed copy.eps

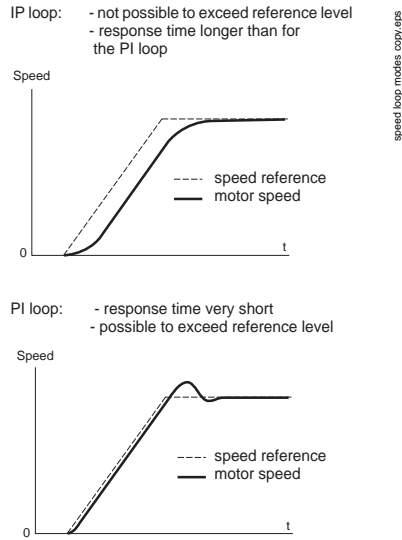
+ Speed/ - Speed with Single Action Pushbuttons and No Reference Saving: Str = SRE

Altivar® 58 TRX AC Drives

Type FVC Adjustment Parameters

Speed Loop Modes

Two speed loop modes are available for fine tuning drive controller performance. IP mode is used for applications in which speed overshoot is not an acceptable response to a change in speed reference. In this mode, a fixed filter in the speed reference line improves noise immunity and steady state speed regulation. PI mode is used in applications that require the fastest response to a change in speed reference and/or change in motor loading.



Motor Fluxing Options

Motor fluxing can improve acceleration response time by establishing magnetic flux in the motor before it receives a run command. There are three motor fluxing options:

- Continuous mode: flux is established and maintained in the motor as long as power is applied to the drive controller.
- Motor fluxing by logic input: A logic input is assigned to the motor fluxing function. When the assigned logic input goes high, flux builds in the motor.
- Normal operation: if the logic input is not active when a run command is given or if no logic input has been assigned to the function, flux builds in the motor when it starts up. This is the factory setting.

The flux current is equal to 1.5 times configured nominal motor current until full flux is established; it is then adjusted to the motor no-load current.

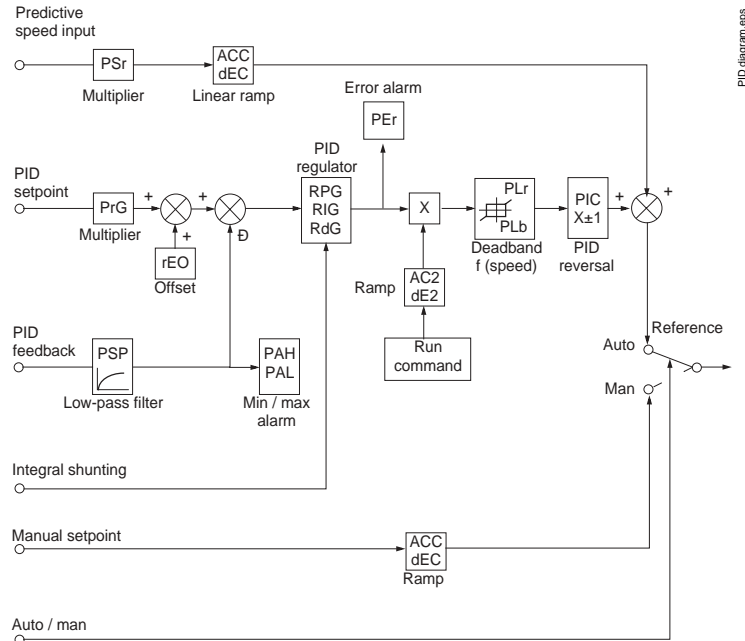
Motor fluxing options can be selected in open or closed loop control modes.

Control Mode

This function is used to select open loop or closed loop operation.

PID Regulator

This function is used to regulate a process with a reference and a feedback given by a sensor. A speed input gives an initial (or predictive) setpoint for start-up. In PID regulator mode the ramps are linear, even if they are configured differently. PID Regulator mode is active if an AI input is assigned to PID Feedback.

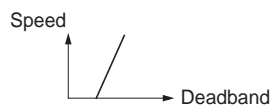


PID Regulator parameters:

- Speed Input: digital setpoint via communication link; analog input AI3.
- PID Setpoint: digital setpoint via communication link; 2 or 4 setpoints preset via logic input; analog Input AI1 (\pm AI2 \pm AI3).
- PID Feedback: analog input AI2 or AI3.
- Manual Setpoint (speed regulation mode): analog input AI3.
- Integral shunting: logic input LI: integral shunted if LIx=1.
- Auto/manual:
 - Logic input LI for switching operation to speed regulation (man) if LIx = 1, or PID regulation (auto) if LIx = 0.

In automatic mode the following actions are possible:

- Adapt the setpoint input to the process feedback: GAIN (PrG) and OFFSET (rEO).
- Correct PID inversion.
- Adjust the proportional, integral, and derivative gain (RPG, RIG and RdG).
- Use the “alarm” on logic output if a threshold is exceeded (Max. feedback, Min. feedback, and PID error).
- Assign an analog output for the PID setpoint, PID feedback, and PID error.
- Limit the action of the PID according to the speed, with an adjustable base and ratio:



- Apply a ramp to establish the action of the PID on starting (AC2) and stopping (dE2).
- The motor speed is limited between LSP and HSP and is displayed as a percentage.

Altivar® 58 TRX AC Drives

Type FVC Analog Inputs

Preset Setpoints for PID Regulator:

2 or 4 preset setpoints require the use of 1 or 2 logic inputs respectively:

2 Preset Setpoints		4 Preset Setpoints		
Assign: Llx to Pr2		Assign: Llx to Pr2, then Lly to Pr4		
Llx	Reference	Lly	Llx	Reference
0	Analog reference	0	0	Analog reference
1	Process max	0	1	PI2 (adjustable)
		1	0	PI3 (adjustable)
		1	1	Process max

ATV58 TYPE FVC ANALOG INPUTS

Analog Torque Limit:

This function is for load compensation, torque or traction correction applications. It is available only with an I/O extension card with analog input AI3. The signal applied at AI3 operates in a linear fashion on the internal torque limit (parameter TLI in the Drive menu):

If AI3 = 0 V: limit TLI x 0 = 0; If AI3 = 10 V: limit TLI.

Encoder Input Application Function with I/O Extension Card And Encoder Input:

This function provides speed reference summing. The setpoint from the encoder input is summed with AI1 (see documentation supplied with the card). Applications include:

- Synchronization of the speed of a number of drive controllers. Parameter PLS on the DRIVE menu is used to adjust the speed ratio of one motor in relation to that of another.
- Setpoint via encoder.

Encoder Input Application Function with Control Card:

This function provides closed loop flux vector control with sensor (inputs A, A-, B, B-). This relates to the encoder connected to the control card. It is used for fine speed adjustments, irrespective of the state of the load, and for control optimization (flux vector control mode in closed loop: Ctr = closed loop, DRIVE menu).

Consistency between the motor frequency and the speed feedback is monitored in the drive controller fault management system. If there is no encoder signal (FVC mode) or if the motor frequency and speed feedback are not consistent, the drive controller gives a speed feedback fault and locks with code SPF. During operation, if the difference between the motor frequency and the speed feedback is greater than 5 Hz, the drive controller gives a speed feedback fault and locks with code SPF. If the speed feedback is greater than 1.2 x maximum frequency, the drive controller gives an overspeed fault with code SOF.

ATV58 TYPE FVC ANALOG OUTPUTS

Signed Ramp (Code ORS)

When configured for signed ramp, the analog output provides a signal proportional to the drive controller's internal frequency ramp. This output is scaled to indicate rotation direction. AOL corresponds to the maximum frequency (parameter tFr) in the reverse direction. AOH corresponds to the maximum frequency (parameter tFr) in the forward direction. $(AOH + AOL) / 2$ corresponds to zero frequency.

PID Setpoint (Code OPS)

The image of the PID regulator setpoint. AOL corresponds to the minimum setpoint. AOH corresponds to the maximum setpoint.

PID Feedback (Code OPF)

The image of the PID regulator feedback. AOL corresponds to the minimum feedback. AOH corresponds to the maximum feedback.

PID Error (Code OPE)

The image of the PID regulator error as a percentage of the sensor range (maximum feedback minus minimum feedback). AOL correspond to -5%. AOH corresponds to +5%. $(AOH + AOL) / 2$ corresponds to zero.

PID Integral (Code OPI)

The image of the PID regulator error integral. AOL corresponds to LSP. AOH corresponds to HSP.

ATV58 TYPE FVC LOGIC OUTPUTS

The programmable relay, R2, on the drive controller or the programmable logic output, LO, on an I/O extension card can be configured for the following additional functions:

PID Error (Code PEE)

Can be assigned to R2 or LO. The logic output is active (state 1) or the relay is energized if the PID regulator output error is greater than the threshold set by parameter PEr.

PID Feedback Alarm (Code PFA)

Can be assigned to R2 or LO. The logic output is active (state 1) if the PID feedback moves outside the range set by parameters PAH and PAL.

Altivar® 58 TRX AC Drives

Parameter Summary

PARAMETER SUMMARY

The following tables show the ATV58 TRX Type H configuration parameters. This page can be copied and used as a worksheet to customize settings for your application.

Adjustment Parameters

Code	Fact. Setting	Cust. Setting	Code	Fact. Setting	Cust. Setting
<i>RCb</i>	no		<i>SP6</i>	30 Hz	Hz
<i>RCc</i>	3 s	s	<i>SP7</i>	35 Hz	Hz
<i>dEc</i>	3 s	s	<i>JOG</i>	10 Hz	Hz
<i>LSP</i>	0 Hz	Hz	<i>JGt</i>	0.5 s	s
<i>HSP</i>	50 / 60 Hz	Hz	<i>brL</i>	0 Hz	Hz
<i>FLG</i>	20%	%	<i>ibr</i>	0 A	A
<i>StR</i>	20%	%	<i>brt</i>	0 s	s
<i>IEH</i>	0.9 of I_n	A	<i>ben</i>	0 Hz	Hz
<i>Idc</i>	0.7 ItH	A	<i>bet</i>	0 s	s
<i>tdc</i>	0.5 s	s	<i>FFt</i>	50/60 Hz	Hz
<i>SdC</i>	Varies	A	<i>rPG</i>	1	
<i>JPF</i>	0 Hz	Hz	<i>rIG</i>	1 / s	/ s
<i>JF2</i>	0 Hz	Hz	<i>PSP</i>	0.0 s	s
<i>JF3</i>	0 Hz	Hz	<i>Fb5</i>	0.1	
<i>RC2</i>	5 s	s	<i>PIC</i>	no	
<i>dE2</i>	5 s	s	<i>P12</i>	30%	%
<i>tL5</i>	no	no or s	<i>P13</i>	60%	%
<i>USC</i>	1		<i>dt d</i>	105%	%
<i>UFr</i>	100%	%	<i>dt 5</i>	1	
<i>SLP</i>	100%	%	<i>ct d</i>	1.36 of I_n	A
<i>PFL</i>	20%	%	<i>td d</i>	100%	%
<i>SP2</i>	10 Hz	Hz	<i>tL2</i>	200%	%
<i>SP3</i>	15 Hz	Hz	<i>Ftd</i>	50/60 Hz	Hz
<i>SP4</i>	20 Hz	Hz	<i>F2 d</i>	50/60 Hz	Hz
<i>SP5</i>	25 Hz	Hz			

Drive Menu Parameters

Code	Factory Setting	Customer Setting	Code	Factory Setting	Customer Setting
<i>UnS</i>	depends on catalog number	V	<i>Stt</i>	STN	
<i>Frs</i>	50 / 60 Hz	Hz	<i>dCF</i>	4	
<i>nCr</i>	0.9 of I_n	A	<i>tL1</i>	200%	%
<i>nSP</i>	depends on catalog number	rpm	<i>CL1</i>	1.36 of I_n	
<i>CD5</i>	depends on catalog number		<i>RdC</i>	yes	
<i>tUn</i>	no		<i>PCC</i>	1	
<i>tFr</i>	60 / 72 Hz	Hz	<i>SFt</i>	LF	
<i>nLd</i>	no		<i>SFr</i>	depends on catalog number	kHz
<i>Fdb</i>	no		<i>nrd</i>	yes	
<i>Frt</i>	0 Hz	Hz	<i>SPC</i>	no	
<i>rPt</i>	LIN		<i>PGt</i>	DET	
<i>brR</i>	no		<i>PL5</i>	1024	

Command Menu Parameters

Code	Factory Setting	Customer Setting	Code	Factory Setting	Customer Setting
<i>tCC</i>	2 W		<i>RdH</i>	20 mA	mA
<i>tCt</i>	LEL		<i>St r</i>	no	
<i>rIn</i>	no		<i>LCC</i>	no	
<i>bSP</i>	no		<i>PSt</i>	yes	
<i>CrL</i>	4 mA	mA	<i>Rdd</i>	0	
<i>CrH</i>	20 mA	mA	<i>tbr</i>	19200	
<i>RdL</i>	0 mA	mA	<i>rPr</i>	no	

Fault Menu Parameters

Code	Fact. Setting	Cust. Setting	Code	Fact. Setting	Cust. Setting
<i>R L r</i>	no		<i>L F L</i>	no	
<i>n B r</i>	5		<i>L F F</i>	0	
<i>t B r</i>	30.0 s		<i>F L r</i>	no	
<i>r S t</i>	RSP		<i>S t P</i>	no	
<i>D P L</i>	yes		<i>S d d</i>	no	
<i>I P L</i>	yes		<i>E P L</i>	no	
<i>t H t</i>	ACL				

I/O Assignment

Logic Inputs	Customer Setting	Analog Inputs	Customer Setting	Analog Outputs and Logic Outputs	Customer Setting
LI1		AI1		r1	
LI2		AI2		r2	
LI3				AO1	
LI4					
LI5		AI3		AO	
LI6				LO	

NOTE: Shaded rows indicate I/O available on extension cards.

Altivar® 58 TRX AC Drives

Menu Overview

MENU OVERVIEW

Menu 1 – DISPLAY Menu

Parameter	Code
Drive State	rJY
Steady State	rUn
Accelerating	ACC
Decelerating	dEc
I _n Current Limit	CLI
DC Injection Braking	dCb
Freewheel Stop	nSt
Braking with Ramp Mod	ObR
Frequency Reference	LFr
LCU	LCU
Frequency Reference	FrH
Output Frequency	rFr
Motor Speed	SPd
Motor Current	LCr
Machine Speed	USP
Output Power	OPr
Mains Voltage	ULn
Motor Thermal	tHr
Drive Thermal	tHd
Last Fault	LFT
Consumption (wH)	APH
Run Time (Hours)	rTH

Menu 2 – ADJUST Menu

Parameter	Code	Factory Setting
Frequency Reference	LFr	
LCU	LCU	0.00
Inv. Phases	ACb	no
Acceleration	-s ACC	3 s
Deceleration	-s dEC	3 s
Accelerate 2	-s AC2	5 s
Decelerate 2	-s dE2	5 s
Low Speed	-Hz LSP	0 Hz
High Speed	-Hz HSP	50 / 60 Hz
Gain	-% FLG	20%
Stability	-% StA	20%
Thermal Current	-A tIH	0.9 I _n
DC Injection Time	-s tdC	0.5 s
DC Injection Curr	-A IdC	0.7 I _H
Cont. DC Injection Curr	-A SdC	Varies
Jump Freq.	-Hz JPF	0 Hz
Jump Freq. 2	-Hz JF2	0 Hz
Jump Freq. 3	-Hz JF3	0 Hz
LSP Time	-s tLS	no
Machine Speed Coeff.	USC	1
IR Compensation	-% UFr	100%
Slip Comp.	-% SLP	100%
Preset Sp.2	-Hz SP2	10 Hz
Preset Sp.3	-Hz SP3	15 Hz
Preset Sp.4	-Hz SP4	20 Hz
Preset Sp.5	-Hz SP5	25 Hz
Preset Sp.6	-Hz SP6	30 Hz
Preset Sp.7	-Hz SP7	35 Hz
Frequency Lev.Att	-Hz Ftd	50 / 60 Hz
Frequency Lev2.Att	-Hz F2d	
Torque Limit 2	-% tL2	200%
Current Level Att.	-A CtL	1.36 of I _n
Brake Release Lev	-Hz brL	0 Hz
Brake Release I	-A lbr	0 A
Brake ReleaseTime	-s brt	0 s
Brake Engage Lev	-Hz bEn	0 Hz
Brake EngageTime	-s bEt	0 s
Trip Threshold NST	-Hz FFt	
Tachometer Coeff. *	dtS	1
Jog Freq.	-Hz JOG	10 Hz
Jog Delay	-s JGt	0.5 s
V/f Profile	-% PFL	20%
Thermal Level Att.	-% ttd	100%
PI Prop. Gain	rPG	1
PI Int. Gain	rIG	1/s
PI Filter	PSP	0.0
PI Coeff	FbS	0.1
PI Inversion	PIC	no
PI Preset 2	% PI2	30%
PI Preset 3	% PI3	60%
ATV th. fault	dtL	105%

* Requires addition of I/O option card
VW3A58201U (analog) or VW3A58202U (digital)

Menu 3 – DRIVE Menu

Parameter	Code	Factory Setting
Nom. Motor Volt	-V UnS	depends on cat. #
Nom. Motor Freq.	-Hz FrS	50 / 60 Hz
Nom. Motor Curr	-A nCr	0.9 of I _n
Nom. Motor Speed	-rpm nSP	depends on cat. #
Motor CosPhi (power fact.)	CoS	depends on cat. #
Auto Tuning	tUn	no
Max. Frequency	-Hz tFr	60 / 72 Hz
Energy Economy	rLd	no
I Limit Adapt.	Fdb	no
Dec Ramp Adapt	brA	no
Switch Ramp 2	-Hz Frt	0 Hz
Type of Stop	Stt	Stn
Standard Stop	Stn	
Fast Stop	FSt	
Freewheel	rSt	
DC Injection	DCI	
Ramp Type	rPt	LIn
Linear Ramp	LIn	
S Ramp	S	
U Ramp	U	
Dec Ramp Coef.	dCF	4
Torque Limit	tLI	200 %
Int. I Limit	CLI	1.36 of I _n
Auto DC Inj.	AdC	yes
Mot. Power Coef.	PCC	1
Switching Freq. Type	SFT	LF
Range of 0.5 to 4 kHz	LF	depends on cat. #
Range of 4 to 16 kHz	HF1	depends on cat. #
High Duty Cycle w/ derat.	HF2	depends on cat. #
Sw. Freq 0.5 to 16	-kHz SFr	0.5 to 16 kHz
Noise Reduction	nrd	yes
Special Motor	SPC	no
no		
yes		
PSM (small motor)		
PG (feedback sensor) type *	PGt	dEt
Incremental Encoder	InC	
Detector (pulse or edge)	dEt	
Num. Pulses *	PLS	1

Menu 4 – CONTROL Menu

Parameter	Code	Factory Setting
Terminal Strip Con	tCC	2 W
Two Wire 2W	2 W	
Three Wire 3W	3 W	
Type 2 Wire	tCt	LEL
No Transition	LEL	
Low to High Trans.	TRN	
Forward Input Pri.	PFO	
Inhibit Reverse	rIn	
Low Speed Magmt	bSP	
Linear LSP to HSP	no	no
Pedestal Start	BLS	no
Deadband Start	BNS	
AI2 Min. Ref.	-mA CrL	4 mA
AI2 Max. Ref.	-mA CrH	20 mA
Min. Val. AO	mA AOL	0 mA
Max. Val. AO	mA AOH	20 mA
Reference Memory	Str	no
No memory	no	
Run Com. removed	RAM	
Power removed	EEP	
Keypad Com.	LCC	no
Stop Priority	PSt	yes
Drive Address	Add	0
Bd Rate RS-485	tbr	
Reset Counters	rPr	

These diagrams include all parameters that may appear in the designated menu. The parameters actually visible on your drive controller depends on its configuration and the options installed.

Altivar® 58 TRX AC Drives Menu Overview

Menu 5 – I/O Menu

Parameter	Code	Factory Setting
LI2 Assign	LI2	
LI3 Assign	LI3	
LI4 Assign	LI4	
LI5 Assign *	LI5	
LI6 Assign *	LI6	
Not assigned	no	
RV: Reverse	RV	
Switch Ramp2	RP2	
JOG	JOG	
+SP: +Speed	SP	
-Speed	-SP	
2 preset Sp	PS2	
4 preset Sp	PS4	
8 preset Sp	PS8	
Freewheel Stop	NST	
DC inject	OCI	
Fast stop	FSt	
Multi. Motor	CHP	
TorqueLim2	TL2	
Forced Local	FLO	
Fault Reset	rSt	
Auto/manu	RFC	
Auto-tune	Atn	
PI Auto/Man	PAU	
PI 2 Preset	Pr2	
PI 4 Preset	Pr4	
External flt	EDD	
Torque Limit by AI	tLA	
AI2 Assign	AI2	
AI3 Assign *	AI3	
Not assigned	no	
Speed ref 2	Fr2	
Summed ref.	SAI	
PI regulator	PIF	
PI Manual Ref.*	PIM	
Tacho feedback *	SFb	
Therm. Sensor *	PtC	
Torque Limit *	AtL	
Encoder feedback *	RGI	
R2 Assign / LO assign	r2 / LO	
Not assigned	no	
Drive running	rUn	
Output contactor	OCC	
Freq reference attain.	FtA	
HSP attained	FLA	
Current level attained	CtA	
Reference Freq. Attain.	SrA	
Motor thermal lvl (Attain)	tSA	
Brake logic	bLC	
4-20mA loss	APL	
F2 attained	F2A	
ATV th. alarm	TAD	
AO1 Assign	AO1	
AO Assign	AO	
Not assigned	no	
Motor current	OCr	
Motor frequency	OFr	
Output ramp	OrP	
Motor torque	trM	
Signed Torque	StM	
Signed Ramp	OrS	
PI Reference	OPS	
PI Feedback	OPF	
PI Error	OPE	
PI Integral	OPI	
Motor Power	OPr	
Motor Thermal	tHr	
Drive Thermal	tHd	

Menu 6 – FAULT Menu

Parameter	Code	Factory Setting
Auto Restart	Atr	no
Nb Max Reset	nAr	5
Reset Pause	tAr	30.0 s
Reset Type	rSt	RSP
Partial Reset	rSP	
Total Reset	rSG	
Output Phase Loss	OPL	yes
Input Phase Loss	IPL	yes
Thermal Protection	tHt	ACL
No motor protection	no	
Self Cooled motor	ACL	
Force Cooled motor	FCL	
Loss Follower	LFL	no
Immediate Fault	yes	
Restart on Signal Return	Stt	
Stop and Fault	LSF	
Run at Preset Speed	LFF	
Run at last speed	RLS	
Catch On Fly	FLr	no
Controlled Stop	StP	no
Phase loss drive trip	no	
Maintain DC Bus	MMS	
Follow Ramp	FRP	
Ramp not Followed *	Sdd	no
External Fault	EPL	yes

Menu 7 – FILES Menu

Parameter	Code	Factory Setting
File 1 State	F1S	FREE
File 2 State	F2S	FREE
File 3 State	F3S	FREE
File 4 State	F4S	FREE
Operation Type	F0t	no
No Operation Req.	no	
Save Configuration	StR	
Transfer File to Drive	REC	
Return to Factory Set	In1	
Password	Cod	0000

LANGUAGE Menu

Parameter	Code
English	LNG
Francais	LNG
Deutsch	LNG
Espanol	LNG
Italiano	LNG

MACRO-CONFIG Menu

Parameter	Code
Hdg: Material Handling	CFG
Gen: General Use	CFG
VT: Variable Torque	CFG
CUS: Customize	CFG

* Requires addition of I/O option card VW3A58201U (analog) or VW3A58202U (digital)

Altivar® 58 TRX AC Drives Communication Parameters

NOTE: Refer to
bulletin
VVDED397058US for
specific address
numbers and more
information.

COMMUNICATION PARAMETERS (PARAMETERS AVAILABLE VIA THE COMMUNICATION LINK)

The communication link identifies ATV58 TRX drive controllers as a series of holding registers. The tables in this section describe the content of the registers to show what information is available. The registers are grouped by the following functions and are in numerical order:

- General configuration registers.
- Drive configuration registers.
- I/O configuration registers.
- Fault configuration registers.
- Adjustment registers.
- Control registers.
- Display registers.
- Special DRIVECOM registers.

General Configuration Registers

Word	Code	Units	Description	Possible Values or Range
W1 or 16#5FE0/1	CIC	—	Incorrect configuration Upon power up, read CIC: If CIC = 0: normal If CIC ≠ 0: malfunction Write CIC to 0 to return to factory settings.	Bit 0 = 0: Normal rating Bit 0 = 1: Drive controller rating modified Bit 1 = 0: Option card detection normal Bit 1 = 1: Type of option card modified Bit 2 = 0: Option card detection normal Bit 2 = 1: Option card removed Bit 3 = 0: Contents of EEPROM correct Bit 3 = 1: Contents of EEPROM incorrect Bits 4 to 15: Reserved
W3 or 16#5FE0/3	CFG	—	Macro-configuration. Modification of this parameter reassigns other parameters.	0 = HDG: Material handling 1 = GEN: General use 2 = VT: Variable torque (except Type FVC)
W4 or 16#5FE0/4	CRL	0.1 mA	Minimum reference of input AI2	0–200 (0 to 20.0 mA)
W5 or 16#5FE0/5	CRH	0.1 mA	Maximum reference of input AI2	40–200 (4.0 to 20.0 mA)
W6 or 16#5FE0/6	TCC	—	2-wire/3-wire control via terminals. Modification of this parameter will reassign the I/O.	0 = 2W: 2-wire control 1 = 3W: 3-wire control
W7 or 16#5FE0/7	TCT	—	Type of 2-wire control	0 = LEL: Level detection (0 or 1) 1 = TRN: Transition detection (switching from 0 to 1 or 1 to 0) 2 = PFO: Transition detection with priority given to forward over reverse
W8 or 16#5FE0/8	PST	—	STOP key has priority (regardless of assigned control mode—i.e., terminal strip, keypad, or serial link)	0 = No 1 = Yes
W9 or 16#5FE0/9	STR	—	Speed reference storage (+/–Speed)	0 = NO: Reference not saved 1 = RAM: Reference saved in RAM 2 = EEP: Reference saved in EEPROM 3 = SRE: Reference adjustment range limited by parameter SRP (Type FVC only)
W10 or 16#5FE0/A	ADD	—	Drive address via the standard RS-485 serial link.	0 to 31 0 = Broadcasting without response
W11 or 16#5FE0/B	ORT	—	Drive power overrating for variable torque applications Modifying this parameter returns the following parameters to the factory settings: UNS, NCR, NSP, COS, TUN, ITH and IDC. This parameter can be modified on ATV58 Type H controllers when the macro-configuration (CFG, W3) is set to variable torque (VT). See instruction bulletin VVDED397047US (latest revision) for a complete description. For ATV58 Type FVC models, this parameter is always at 0.	0 = No (high overtorque) 1 = Yes (standard overtorque)
W12 or 16#5FE0/C	RIN	—	Inhibits operation of the motor in the reverse direction (by logic input, analog input, serial command, or REV key on the keypad display)	0 = No 1 = Yes
W13 or 16#5FE0/D	BSP	—	Manage low speed operation as a function of the analog reference	0 = No: Normal 1 = BLS: Peak limiting (deadband) 2 = BNS: Base limiting (pedestal)
W14 or 16#5FE0/E	AOL	0.1 mA	Minimum reference of analog output AO and AO1	0 to 200 (0 to 20.0 mA)
W15 or 16#5FE0/F	AOH	0.1 mA	Maximum reference of analog output AO and AO1	0 to 200 (0 to 20.0 mA)

General Configuration Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W16 or 16#5FE0/10	TBR	—	Communication speed through the RS-485 port	7 = 9600 baud 8 = 19200 baud
W17 or 16#5FE0/11	RPR	—	Reset kWh or total running time	0 = No 1 = APH: Reset to 0 the kWh 2 = RTH: Reset to 0 the total running time

Drive Configuration Registers

Word	Code	Units	Description	Possible Values or Range
W50 or 16#5FE1/1	SFT	—	Switching frequency range. Adjusting this parameter changes the following parameters to the factory setting: SFR (W51)*NCR (W54) NRD (W60)*CLI (W72) ITH (W258)*IDC (W270) IBR (W277)*CTD (W282)	0 = LF: Low frequency 1 = HF1: High frequency without derating. If th ≥ 95%, switch to 4 kHz. If th < 70%, return to SFR frequency. 2 = HF2: High frequency with derating by one rating
W51 or 16#5FE1/2	SFR	—	PWM switching frequency (Values 5 and 6 are not on all drive ratings)	0 = 0.5 kHz if SFT = LF 1 = 1 kHz if SFT = LF 2 = 2 kHz if SFT = LF 3 = 4 kHz if SFT = LF 4 = 8 kHz if SFT = HF1 or HF2 5 = 12 kHz if SFT = HF1 or HF2 6 = 16 kHz if SFT = HF1 or HF2
W52 or 16#5FE1/3	TFR	0.1 Hz	Maximum output frequency	If SFR = 0.5 kHz: 10.0 to 62.0 If SFR = 1 kHz: 10.0 to 125.0 If SFR = 2 kHz: 10.0 to 250.0 If SFR = 4 kHz: 10.0 to 500.0 If SFR = 8 kHz: 10.0 to 500.0 If SFR = 12 kHz: 10.0 to 500.0 If SFR = 16 kHz: 10.0 to 500.0
W53 or 16#5FE1/4	FRS	0.1 Hz	Nominal motor frequency	100–5000 (10.0 to 500.0 Hz)
W54 or 16#5FE1/5	NCR	0.1 A	Nominal motor current	0.25 INV to 1.36 INV (INV = drive controller nominal current)
W55 or 16#5FE1/6	UNS	1 V	Nominal motor voltage	ATV58***M2: 200 to 240 ATV58***N4: 200 to 500 ATV58F***N4: 200 to 500
W56 or 16#5FE1/7	NSP	1 rpm	Nominal motor speed	0 to 32767
W57 or 16#5FE1/8	COS	0.01	Motor cosine Phi (power factor)	0.50 to 1.00
W58 or 16#5FE1/9	TLI	1%	Torque limit	0 to 200
W59 or 16#5FE1/A	TUN	—	Auto-tune of motor	0 = No: auto-tune not performed (value from internal table used). If written to 0: return to value from table 1 = Yes: auto-tune command 2 = Done: auto-tune performed
W60 or 16#5FE1/B	NRD	—	Motor noise reduction by switching frequency modulation	0 = No 1 = Yes
W61 ^[1] or 16#5FE1/C	NLD	—	Energy saving function (VT macro only)	0 = No 1 = Yes
W62 or 16#5FE1/D	RPT	—	Type of acceleration and deceleration ramps	0 = LIN: Linear 1 = S: S-shaped 2 = U: U-shaped 3 = CUS: Customized (Type FVC only)
W63 or 16#5FE1/E	DCF	1	Deceleration reduction coefficient used with Fast Stop: DEC → DCF = Fast Stop ramp	1 to 10
W64 or 16#5FE1/F	BRA	—	Deceleration ramp adaptation	0 = No 1 = Yes
W65 or 16#5FE1/10	FRT	0.1 Hz	Ramp switching threshold (switch to AC2 and DE2 if output frequency > FRT and FRT ≠ 0)	0 to HSP
W66 or 16#5FE1/11	BER	—	Reserved	
W67 or 16#5FE1/12	ADC	—	Automatic DC injection on stop; or, for Type FVC only, if CTR = FVC, zero speed is maintained	0 = No 1 = Yes
W68 or 16#5FE1/13	PLS	1	Number of pulses per encoder revolution (For encoder feedback I/O card)	1 to 1024
W69 ^[1] or 16#5FE1/14	PCC	0.1	Motor power load coefficient (in the event of motor switching)	2 to 10 (0.2 to 1.0)

[1] This parameter does not exist for ATV58 Type FVC drive controllers.

Altivar® 58 TRX AC Drives Communication Parameters

Drive Configuration Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W70 ^[1] or 16#5FE1/15	SPC	—	Special motor	0 = No 1 = Yes 2 = PSM: Use for very small motors or for open circuit output voltage testing.
W71 or 16#5FE1/16	PGT	—	Type of motor shaft speed sensor (Indicates the number of signals wired to the encoder feedback I/O card)	0 = INC: Incremental encoder. A, A-, B, B-, are hard-wired 1 = DET: Detector. Only A is hard-wired
W72 or 16#5FE1/17	CLI	0.1 A	Internal current limit	0.1 to 1.36 x INV (INV = drive controller nominal current)
W73 ^[1] or 16#5FE1/18	FDB	—	Current limit adaptation based on output frequency (VT macro only)	0 = No 1 = Yes
W74 or 16#5FE1/19	FLU	—	Motor fluxing	0 = FNC: Non-continuous fluxing 1 = FCT: Continuous fluxing
W75 or 16#5FE1/1A	CTR	—	Control mode selection	0 = SVC: Open loop 1 = FVC: Closed loop
W76 or 16#5FE1/1B	PGI	1	Number of pulses per encoder revolution (control card)	100 to 5000
W77 or 16#5FE1/1C	SSL	—	Type of speed loop selection	0 = IP: IP structure 1 = PI: PI structure
W78 or 16#5FE1/1D	ENC	—	Check encoder feedback Do not write values 0 or 2. Do not write value 1 if W78 = 2.	0 = No: test not performed 1 = Yes: perform the test 2 = Done: test performed
W79 or 16#5FE1/1E	STT	—	Type of stop. The type of stop assigned by this parameter is carried out until the motor frequency drops below the setting of parameter FFT (W313), after which the motor freewheel stops.	0 = STN: Normal ramp stop 1 = FST: Fast stop 2 = NST: Freewheel stop 3 = DCI: DC injection stop

[1] This parameter does not exist for ATV58 Type FVC drive controllers.

I/O Configuration Registers

Word	Code	Description	Possible Values or Range
W100 or 16#5FE2/1	LI1	Assignment of logic input LI1	1 = STP: Stop (if TCC = 3W) 2 = FW: Forward operation (if TCC = 2W)
W101 or 16#5FE2/2	LI2	Assignment of logic input LI2	0 = NO: Not assigned 2 = FW: Forward operation (if TCC = 3W) 3 = RV: Reverse operation 4 = RP2: Ramp switching 5 = JOG: Jog operation 6 = +SP: +Speed 7 = -SP: -Speed 8 = PS2: 2 preset speeds 9 = PS4: 4 preset speeds 10 = PS8: 8 preset speeds 11 = RFC: Reference switching 12 = NST: Freewheel stop 13 = DCI: DC injection stop 14 = FST: Fast stop 15 = FST: Fast stop 16 = CHP: Motor switching; or open loop/closed loop switching ^[1] 17 = TL2: Second torque limit 18 = FLO: Force to local 19 = RST: Clear faults 20 = ATN: Auto tune 21 = SPM: Save reference ^[1] 22 = FLI: Motor fluxing ^[1] 23 = PAU: PID auto-man 24 = PIS: PID integral shunting ^[1] 25 = PR2: 2 preset PID references 26 = TLA: Torque limit by AI 27 = EDD: External fault
W102 or 16#5FE2/3	LI3	Assignment of logic input LI3	0 = NO: Not assigned 3 = RV: Reverse operation 4 = RP2: Ramp switching 5 = JOG: Jog operation 6 = +SP: +Speed 7 = -SP: -Speed 8 = PS2: 2 preset speeds 9 = PS4: 4 preset speeds 10 = PS8: 8 preset speeds 11 = RFC: Reference switching 12 = NST: Freewheel stop 13 = DCI: DC injection stop 14 = FST: Fast stop 15 = CHP: Motor switching; or open loop/closed loop switching ^[1] 16 = TL2: Second torque limit 17 = FLO: Force to local 18 = RST: Clear faults 19 = ATN: Auto tune 20 = SPM: Save reference ^[1] 21 = FLI: Motor fluxing ^[1] 22 = PAU: PID auto-man 23 = PIS: PID integral shunting ^[1] 24 = PR2: 2 preset PID references 25 = PR4: 4 preset PID references 26 = TLA: Torque limit by AI 27 = EDD: External fault
W103 or 16#5FE2/4	LI4	Assignment of logic input LI4	0 = NO: Not assigned 3 = RV: Reverse operation 4 = RP2: Ramp switching 5 = JOG: Jog operation 6 = +SP: +Speed 7 = -SP: -Speed 8 = PS2: 2 preset speeds 9 = PS4: 4 preset speeds 10 = PS8: 8 preset speeds 11 = RFC: Reference switching 12 = NST: Freewheel stop 13 = DCI: Injection stop 14 = FST: Fast stop 15 = CHP: Motor switching; or open loop/closed loop switching if CTR = FVC ^[1] 16 = TL2: Second torque limit 17 = FLO: Forced local mode 18 = RST: Fault reset 19 = ATN: Auto tune 20 = SPM: Save reference ^[1] 21 = FLI: Motor fluxing ^[1] 22 = PAU: PID auto-man 23 = PIS: PID integral shunting ^[1] 24 = PR2: 2 preset PID references 25 = PR4: 4 preset PID references 26 = TLA: Torque limit by AI 27 = EDD: External fault

[1] Values specific to ATV58 Type FVC models

I/O Configuration Registers (Continued)

Word	Code	Description	Possible Values or Range
W104 or 16#5FE2/5	LI5	Assignment of logic input LI5	0 = NO: Not assigned 3 = RV: Reverse operation 4 = RP2: Ramp switching 5 = JOG: Jog operation 6 = +SP: +Speed 7 = -SP: -Speed 8 = PS2: 2 preset speeds 9 = PS4: 4 preset speeds 10 = PS8: 8 preset speeds 11 = RFC: Reference switching 12 = NST: Freewheel stop 13 = DCI: Injection stop 14 = FST: Fast stop 15 = CHP: Motor switching; or open loop/closed loop switching if CTR = FVC ^[1] 16 = TL2: Second torque limit 17 = FLO: Forced local mode 18 = RST: Fault reset 19 = ATN: Auto tune 20 = SPM: Save reference ^[1] 21 = FLI: Motor fluxing ^[1] 22 = PAU: PID auto-man 23 = PIS: PID integral shunting ^[1] 24 = PR2: 2 preset PID references 25 = PR4: 4 preset PID references 26 = TLA: Torque limit by AI 27 = EDD: External fault
W105 or 16#5FE2/6	LI6	Assignment of logic input LI6	0 = NO: Not assigned 3 = RV: Reverse operation 4 = RP2: Ramp switching 5 = JOG: Jog operation 6 = +SP: +Speed 7 = -SP: -Speed 8 = PS2: 2 preset speeds 9 = PS4: 4 preset speeds 10 = PS8: 8 preset speeds 11 = RFC: Reference switching 12 = NST: Freewheel stop 13 = DCI: Injection stop 14 = FST: Fast stop 15 = CHP: Motor switching; or open loop/closed loop switching if CTR = FVC ^[1] 16 = TL2: Second torque limit 17 = FLO: Forced local mode 18 = RST: Fault reset 19 = ATN: Auto tune 20 = SPM: Save reference ^[1] 21 = FLI: Motor fluxing ^[1] 22 = PAU: PID auto-man 23 = PIS: PID integral shunting ^[1] 24 = PR2: 2 preset PID references 25 = PR4: 4 preset PID references 26 = TLA: Torque limit by AI 27 = EDD: External fault
W107 or 16#5FE2/8	AI2	Assignment of analog input AI2	0 = NO: Not assigned 2 = FR2: Speed reference 2 3 = SAI: Summing reference 4 = PIF: PI feedback (PI control) 8 = ATL: Analog torque limit ^[1] 9 = DAI: Subtracting reference ^[1]
W108 or 16#5FE2/9	AI3	Assignment of analog input AI3 or of encoder input (according to type of I/O card)	0 = NO: Not assigned 2 = FR2 = Speed reference 2 (125–500 hp only) 3 = SAI: Summing reference 4 = PIF: PI feedback (PI control) 5 = SFB: Tachogenerator feedback 6 = RGI: Encoder feedback (except Type FVC models) 7 = PTC: PTC probes 8 = ATL: Analog torque limit 9 = DAI: Subtracting reference ^[1] 10 = PIM: manual speed reference of the PID regulator (auto-man) 11 = FPI: speed reference of the PID regulator (predictive reference) ^[1]
W110 or 16#5FE2/B	R2	Assignment of relay R2	0 = NO: Not assigned 2 = RUN: Drive running 3 = OCC: Downstream contactor control 4 = FTA: Frequency threshold (FTD) reached 5 = FLA: High speed reached 6 = CTA: Current threshold (CTD) reached 7 = SRA: Frequency reference reached 8 = TSA: Thermal threshold (TTD) reached 9 = BLC: Brake sequence 10 = PEE: PID error ^[1] 11 = PFA: PID feedback alarm ^[1] 12 = APL: Loss of 4–20 mA follower signal 13 = F2A: 2nd frequency threshold (F2D) reached 14 = TAD: Drive thermal state threshold reached
W111 or 16#5FE2/C	LO	Assignment of logic output LO	0 = NO: Not assigned 2 = RUN: Drive running 3 = OCC: Downstream contactor control 4 = FTA: Frequency threshold (FTD) reached 5 = FLA: High speed reached 6 = CTA: Current threshold (CTD) reached 7 = SRA: Frequency reference reached 8 = TSA: Thermal threshold (TTD) reached 10 = PEE: PID error ^[1] 11 = PFA: PID feedback alarm ^[1] 12 = APL: Loss of 4–20 mA follower signal 13 = F2A: 2nd frequency threshold (F2D) reached 14 = TAD: Drive thermal state threshold reached
W112 or 16#5FE2/D	AO	Assignment of analog output AO	0 = NO: Not assigned 1 = OCR: Motor current 2 = OFR: Motor speed 3 = ORP: Ramp output 4 = TRQ: Motor torque 5 = STQ: Signed motor torque 6 = ORS: Signed ramp output 7 = OPS: PID reference 8 = OPF: PID feedback 9 = OPE: PID error 10 = OPI: PID integral 11 = OPR: Motor power output 12 = THR: Motor thermal state 13 = THD: Drive thermal state

^[1] Values specific to ATV58 Type FVC models

Altivar® 58 TRX AC Drives Communication Parameters

I/O Configuration Registers (Continued)

Word	Code	Description	Possible Values or Range
W113 or 16#5FE2/E	AO1	Assignment of analog output AO1 (Only on ATV58 Type FVC drive controllers)	0 = NO: Not assigned 1 = OCR: Motor current 2 = OFR: Motor speed 3 = ORP: Ramp output 4 = TRQ: Motor torque 5 = STQ: Signed motor torque 6 = ORS: Signed ramp output 7 = OPS: PID reference 8 = OPF: PID feedback 9 = OPE: PID error 10 = OPI: PID integral 11 = OPR: Motor power output 12 = THR: Motor thermal state 13 = THD: Drive thermal state

[1] Values specific to ATV58 Type FVC models

Fault Configuration Registers

Word	Code	Description	Possible Values or Range
W150 or 16#5FE3/1	ATR	—	Automatic restart
W151 or 16#5FE3/2	OPL	—	Motor phase loss
W152 or 16#5FE3/3	IPL	—	Input phase loss
W153 or 16#5FE3/4	THT	—	Motor thermal protection
W154 or 16#5FE3/5	LFL	—	Loss of follower
W155 or 16#5FE3/6	FLR	—	Catch a spinning load
W156 or 16#5FE3/7	STP	—	Controlled stop on loss of input power
W157 or 16#5FE3/8	SDD	—	Ramp not followed
W158 or 16#5FE3/9	RST	—	Type of reset
W159 or 16#5FE3/A	LFF	0.1 Hz	Default speed if 4–20 mA follower signal is lost.
W160 or 16#5FE3/B	EPL	Response to external fault input issued by logic input	1 = Yes: Immediate fault 3 = LSF: Stop followed by fault indication
W161 or 16#5FE3/C	ACB	Electronic output phase inversion	0 = No 1 = Yes

Adjustment Registers

Word	Code	Units	Description	Possible Values or Range
W250 or 16#5FE5/1	HSP	0.1 Hz	High speed	LSP to TFR
W251 or 16#5FE5/2	LSP	0.1 Hz	Low speed	0 to HSP
W252 or 16#5FE5/3	ACC	0.1 s or 0.01 s	Acceleration (time between 0 and FRS)	0: ramp of 0.05 s (special case) 1 to 9999: ramp of 0.1 s to 999.9 s or 0.01 to 99.99. See INR (W291) for Type FVC.
W253 or 16#5FE5/4	DEC	0.1 s or 0.01 s	Deceleration (time between FRS and 0)	0: ramp of 0.05 s (special case) 1 to 9999: ramp of 0.1 s to 999.9 s or 0.01 to 99.99. See INR (W291) for Type FVC.
W254 or 16#5FE5/5	UFR	1%	IR compensation (adjustment of auto-tune value)	0 to 150 if SPC = No 0 to 800 if SPC = Yes 0 if CFG = VT
W255 or 16#5FE5/6	FLG	1%	Frequency loop gain	0 to 100
W256 [1] or 16#5FE5/7	PFL	1%	V/F ratio profile	0 to 100 if CFG = VT 100 if CFG = HDG or GEN
W257 or 16#5FE5/8	STA	1%	Frequency loop stability	0 to 100
W258 or 16#5FE5/9	ITH	0.1 A	Current setting for motor thermal protection	0.25 to 1.36 x INV (drive controller nominal current)
W259 or 16#5FE5/A	SLP	1%	Slip compensation	0 if CFG = VT 0 to 150 if CFG = HDG or GEN
W260 or 16#5FE5/B	AC2	0.1 s or 0.01 s	Acceleration 2 (time between 0 and FRS)	0: ramp of 0.05 s (special case) 1 to 9999: ramp of 0.1 s to 999.9 s or 0.01 to 99.99. See INR (W291) for Type FVC.
W261 or 16#5FE5/C	DE2	0.1 s or 0.01 s	Deceleration 2 (time between FRS and 0)	0: ramp of 0.05 s (special case) 1 to 9999: ramp of 0.1 s to 999.9 s or 0.01 to 99.99. See INR (W291) for Type FVC.

[1] This parameter does not exist for ATV58 Type FVC drive controllers.

Adjustment Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W262 or 16#5FE5/D	JOG	0.1 Hz	Jog frequency	0 to 100 (0.0 to 10.0 Hz)
W263 or 16#5FE5/E	JGT	0.1 s	Delay between two consecutive jog operations	0 to 20 (0.0 to 2.0 s)
W264 or 16#5FE5/F	SP2	0.1 Hz	Preset speed 2	LSP to HSP
W265 or 16#5FE5/10	SP3	0.1 Hz	Preset speed 3	LSP to HSP
W266 or 16#5FE5/11	SP4	0.1 Hz	Preset speed 4	LSP to HSP
W267 or 16#5FE5/12	SP5	0.1 Hz	Preset speed 5	LSP to HSP
W268 or 16#5FE5/13	SP6	0.1 Hz	Preset speed 6	LSP to HSP
W269 or 16#5FE5/14	SP7	0.1 Hz	Preset speed 7	LSP to HSP
W270 or 16#5FE5/15	IDC	0.1 A	DC injection current level	0.1 to 1.36 x INV (drive controller nominal current)
W271 or 16#5FE5/16	TDC	0.1 s	DC injection time (in the case of automatic DC injection at stop) Type FVC: Zero speed holding time with CTR = closed loop	0 to 300 = 0.0 s to 30.0 s 301 = CONT: continuous injection
W272 or 16#5FE5/17	TLS	0.1 s	Low speed (LSP) dwell timer	0 = No: no limit 1 to 9999 = time of 0.1 s to 999.9 s
W273 ^[1] or 16#5FE5/18	BRL	0.1 Hz	Mechanical brake release threshold	0 to 100 (0.0 to 10.0 Hz)
W274 or 16#5FE5/19	BEN	0.1 Hz	Mechanical brake engage threshold Type FVC: Not significant if CTR = closed loop	0 to LSP
W275 or 16#5FE5/1A	BRT	0.01 s	Mechanical brake release time	0 to 500 (0.00 to 5.00 s)
W276 or 16#5FE5/1B	BET	0.01 s	Mechanical brake engage time	0 to 500 (0.00 to 5.00 s)
W277 or 16#5FE5/1C	IBR	0.1 A	Mechanical brake release current threshold	0 to 1.36 x INV (drive controller nominal current)
W278 or 16#5FE5/1D	TL2	1%	Second torque limit	0 to 200
W279 or 16#5FE5/1E	RPG	0.01	PI proportional gain	1 to 10000 (0.01 to 100.00)
W280 or 16#5FE5/1F	RIG	0.01/s	PI integral gain	1 to 10000 (0.01 to 100.00)
W281 ^[1] or 16#5FE5/20	FBS	0.1	PI feedback scale factor	10 to 1000 (1.0 to 100.0)
W282 or 16#5FE5/21	CTD	0.1 A	Motor current threshold for signalling	0.25 to 1.36 x INV (INV = drive controller nominal current)
W283 or 16#5FE5/22	TTD	1%	Thermal threshold for signalling	0 to 118
W284 or 16#5FE5/23	FTD	0.1 Hz	Frequency threshold for signalling	LSP to HSP
W285 or 16#5FE5/24	DTS	0.01	Tachogenerator feedback scaling (For I/O card with analog input)	100 to 200 (1.00 to 2.00)
W286 or 16#5FE5/25	JPF	0.1 Hz	Skip frequency (frequency range: ±2.5 Hz)	0 to HSP
W287 or 16#5FE5/26	PIC	—	Inverts the PI feedback signal	0 = No (normal) 1 = Yes (inverted)
W288 16#5FE5/27	SDC	0.1 A	Continuous DC injection braking current level on stopping after 30 s. See TDC (W271)	Min: 0.1 x INV Max: 1.36 x INV (INV = drive controller nominal current)
W289 or 16#5FE5/28	USC	0.01	Machine coefficient. Applied to RFR for custom display of machine speed under Display parameter USP (USP = RFR x USC).	1 to 10000 (0.01 to 100.00)
W290 or 16#5FE5/29	BIP	—	Brake release pulse	0 = No: Pulse in the direction requested 1 = Yes: Always pulse in the ascending direction
W291 or 16#5FE5/2A	INR	—	Fine increment in the ramp settings for ACC, DEC, AC2, and DE2	0 = 0.1 s 1 = 0.01 s
W292 or 16#5FE5/2B	SRP	1%	Range of action around the reference for +/- speed function	0 to 50% of the reference
W293 or 16#5FE5/2C	TA1	1%	Rounding of the start of the acceleration ramp	0 to 100% of ramp time

^[1] This parameter does not exist for ATV58 Type FVC drive controllers.

Altivar® 58 TRX AC Drives Communication Parameters

Adjustment Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W294 or 16#5FE5/2D	TA2	1%	Rounding of the end of the acceleration ramp	0 to (100% of ramp time – TA1)
W295 or 16#5FE5/2E	TA3	1%	Rounding of the start of the deceleration ramp	0 to 100% of ramp time
W296 or 16#5FE5/2F	TA4	1%	Rounding of the end of the deceleration ramp	0 to (100% of ramp time – TA3)
W297 or 16#5FE5/30	SPG	1%	PI type speed loop proportional gain	0 to 1000
W298 or 16#5FE5/31	SIG	1%	PI type speed loop integral gain	0 to 1000
W299 or 16#5FE5/32	REO	—	PID regulator reference offset	–999 to +999
W300 or 16#5FE5/33	PAL	1%	PID feedback alarm min. threshold	0 to 100%
W301 or 16#5FE5/34	PAH	1%	PID feedback alarm max. threshold	0 to 100%
W302 or 16#5FE5/35	PER	1%	PID error alarm max. threshold	0 to 100%
W303 or 16#5FE5/36	RDG	0.01	PID regulator derivative gain	0 to 10000 (0 to 100.00)
W304 or 16#5FE5/37	PSP	0.1 s	PID feedback filter time constant	0 to 100 (0 to 10.0)
W305 or 16#5FE5/38	PSR	1%	PID speed input multiplier ratio	0 to 100
W306 or 16#5FE5/39	PLR	1%	PID regulator deadband ratio	0 to 100
W307 or 16#5FE5/3A	PLB	0.1 Hz	PID regulator deadband threshold	0 to HSP
W308 or 16#5FE5/3B	PI2	1%	2nd preset PID reference	0 to 100
W309 or 16#5FE5/3C	PI3	1%	3rd preset PID reference	0 to 100
W310 or 16#5FE5/3D	PRG	—	PID regulator reference gain	–999 to +999
W311 or 16#5FE5/3E	JF2	0.1 Hz	Skip frequency 2 ± 2.5 Hz around setpoint	0 to HSP
W312 or 16#5FE5/3F	JF3	0.1 Hz	Skip frequency 3 ± 2.5 Hz around setpoint	0 to HSP
W313 or 16#5FE5/40	FFT	0.1 Hz	Frequency threshold for start of freewheel stop during deceleration phase if STT (W79) = STN or FST	0 to HSP
W314 or 16#5FE5/41	F2D	0.1 Hz	Second frequency threshold for signalling	LSP to HSP
W315 or 16#5FE5/42	DTD	1%	Drive thermal state threshold value	0–118%
W316 or 16#5FE5/43	SP8	0.1 Hz	Preset speed 8 (125–500 hp only)	LSP to HSP
W317 or 16#5FE5/44	NAR	1	Number of restart attempts	0–255
W318 or 16#5FE5/45	TAR	s	Time between auto restarts	0.1–999.9

[1] This parameter does not exist for ATV58 Type FVC drive controllers.

Control Registers

Word	Code	Units	Description	Possible Values or Range
W400 or 16#5FE7/1	CMD	—	Command word ^[1]	Bit 0 = 0 and Bit 15 = 0: Not ready Bit 0 = 1 and Bit 15 = 0: Ready Bit 1 = 0: Return to "Switch On disabled" status Bit 1 = 1: No action Bit 2 = 0 and Bit 15 = 0: E-stop (rapid deceleration) Bit 2 = 1: No action Bit 3 = 0 and Bit 15 = 0: DRIVECOM stop command Bit 3 = 1 and Bit 15 = 0: DRIVECOM run command Bits 4 to 6: Reserved Bit 7 = 0: No action Bit 7 = 1: Reset faults Bit 8 = 0 and Bit 15 = 1: Activate control via serial link Bit 8 = 1 and Bit 15 = 1: Deactivate control via serial link Bits 9 and 10: Reserved Bit 11 = 0: Normal direction command Bit 11 = 1: Reverse direction command Bit 12 = 0: Motor run command (RUN) Bit 12 = 1: Motor stop command Bit 13 = 0: No action Bit 13 = 1: Stop by DC injection command Bit 14 = 0: No action Bit 14 = 1: Fast stop command Bit 15 = 0: DRIVECOM control register Bit 15 = 1: Non-DRIVECOM control register
W401 or 16#5FE7/2	LFR	0.1 Hz or 0.015 Hz	Serial link frequency reference. ^[1] Signed in two's complement. If bit 9 of CMI is 0, the resolution of LFR is 0.1 Hz (0–5000 = 0.0 to 500.0 Hz). If bit 9 is 1, the resolution of LFR becomes approximately 0.015 Hz per count (0–32767 = 0 to 500 Hz). ATV58 Type FVC only.	LSP to HSP
W402 or 16#5FE7/3	CMI	—	Internal control register (application program). ^[1]	Bit0 = 0: No action Bit0 = 1: Recall factory settings command. This bit automatically resets to 0 after accepting the request; but if CMI is a periodic variable, the PLC program must write it to 0 after the first request has been accepted. ^[2] Bit1 = 0: No action Bit1 = 1: Save configuration/adjustments in EEPROM if voltage is sufficient (no USF fault present). This bit automatically resets to 0 after accepting the request; but if CMI is a periodic variable, the PLC program must write it to 0 after the first request has been accepted. ^[2] Bit2 = 0: No action Bit2 = 1: Recall configuration/adjustments in EEPROM. This bit automatically resets to 0 after accepting the request; but if CMI is a periodic variable, the PLC program must write it to 0 after the first request has been accepted. This bit is inactive if the motor is running. Bit3 = 0: No action Bit3 = 1: External fault command (EPF) Bit4 = 0: No action Bit4 = 1: Ramp switching command Bit5 = 0: No action Bit5 = 1: Motor switching command; or Open loop/closed loop switching (Type FVC only) Bit6 = 0: No action Bit6 = 1: Second torque limit command Bit7: Leave this bit at 0 Bit8 = 0: Normal speed loop ramps (Type FVC only) Bit8 = 1: Short-circuiting of speed loop ramps (Type FVC only) Bit9 = 0: Resolution of keypad or serial link speed reference (LFR) is 0.1 Hz Bit9 = 1: Resolution of keypad or serial link speed reference (LFR) is approximately 0.015 Hz Bits 10 to 11: Reserved Bit12: Reserved Bit13 = 0: Drive controller not locked at stop Bit13 = 1: Drive controller locked at stop Bit14 (NTO) = 0: Control with communication check Bit14 (NTO) = 1: Control without communication check Bit15 = 0: Parameter consistency check Bit15 = 1: No parameter consistency check, drive controller locked at stop. Switching this bit to 0 revalidates all parameters.
W403 or 16#5FE7/4	PISP	0.001	PI setpoint in serial link mode. ^[1] PISP is used only if an analog input is assigned to PIF: PID feedback. When using PISP, LFR (frequency reference) and LFRD (speed reference) have no effect on the motor speed. The analog input for PID feedback remains active in the serial link mode.	0 to 10,000

^[1] Parameter is reinitialized at the end of time-out unless bit 14 (NTO) of CMI (W402 or 16#5FE7/3) is set to 1.

^[2] The EEPROM life limit is 100,000 write operations.

Altivar® 58 TRX AC Drives Communication Parameters

Monitoring Registers

Word	Code	Description	Possible Values or Range
W450 or 16#5FE8/1	FRH	Frequency reference (absolute value)	Value read Units of 0.1 Hz
W451 or 16#5FE8/2	RFR	Output frequency applied to the motor (absolute value)	Value read Units of 0.1 Hz or 0.015 Hz
W452 or 16#5FE8/3	SPD	Motor speed estimated by the drive controller (absolute value)	Value read Units of 1 rpm
W453 or 16#FE8/4	LCR	Motor current	Value read Units of 0.1 A
W454 or 16#5FE8/5	ULN	Line voltage	Value read Units of 0.1 V
W455 or 16#5FE8/6	THR	Motor thermal state (100% = Nominal thermal state, 118% = OLF threshold)	Value read Units of 1%
W456 or 16#5FE8/7	THD	Drive controller thermal state (100% = Nominal thermal state, 118% = OHF threshold)	Value read Units of 1%
W457 or 16#5FE8/8	LFT	Last fault	0 = NOF: No fault saved 1 = INF: Internal fault 2 = EEF: EEPROM memory fault 3 = CFF: Configuration parameters incorrect (on initialization) 4 = CFI: Configuration parameters invalid (if writing a configuration) 5 = SLF: Standard communication link fault (link break) 6 = ILF: Fast communication link fault (link break) 7 = CNF: Fast communication network fault 8 = EPF: External fault 9 = OCF: Overcurrent fault (prolonged ICL) 10 = CRF: Precharge relay fault 11 = SPF: Loss of speed feedback fault 12 = ANF: Ramp not followed fault 13 = LFF: Loss of follower fault (4–20 mA) 14 = TSF: Thermal sensor fault 15 = OTF: Motor overheating fault (thermal sensor) 16 = OHF: Drive controller overheating fault (on heatsink) 17 = OLF: Motor overload fault (thermal simulation or thermal sensor) 18 = OBF: DC bus overvoltage fault 19 = OSF: Input supply overvoltage fault 20 = OPF: Motor phase loss fault 21 = PHF: Input supply phase loss fault (> 1 s) 22 = USF: Input supply undervoltage fault (> 200 ms) 23 = SCF: Motor short circuit fault (motor phase or ground fault) 24 = SOF: Overspeed fault (with speed feedback: 1.11 x HSP; without feedback: 1.2 x TFR)
W458 or 16#5FE8/9	ETA	Drive controller DRIVECOM status word	Bit 0 = 0: Power not ready Bit 0 = 1: Power ready for startup Bit 1 = 0: Drive controller not ready Bit 1 = 1: Drive controller ready (RDY) Bit 2 = 0: DRIVECOM stop Bit 2 = 1: DRIVECOM run Bit 3 = 0: No fault Bit 3 = 1: Fault present (FAI) Bit 4 = 0: Power present Bit 4 = 1: Power not present Bit 5 = 0: E-stop (rapid deceleration) in progress Bit 5 = 1: No E-stop Bit 6 = 0: Status ≠ Switching Disabled Bit 6 = 1: Status = Switching Disabled (freewheel stop) Bit 7 = 0: Alarm absent Bit 7 = 1: Alarm present Bit 8: Reserved Bit 9 = 0: Forced local active (FLO) Bit 9 = 1: Forced local inactive Bit 10 = 0: Speed reference not reached (transient state) Bit 10 = 1: Speed reference reached (steady state) Bit 11 = 0: LFRD reference (in rpm) normal (W603 or 16#6042) Bit 11 = 1: LFRD reference (in rpm) exceeded (> HSP or < LSP) Bits 12 and 13: Reserved Bit 14 = 0: No stop from keypad display STOP key Bit 14 = 1: Stop from keypad display STOP key Bit 15 = 0: Forward direction of rotation (output frequency) Bit 15 = 1: Reverse direction of rotation (output frequency)

Monitoring Registers (Continued)

Word	Code	Description	Possible Values or Range
W459 or 16#5FE8/A	ETI	Drive controller internal status register no. 1	Bit 0 = 0: Write parameters authorized Bit 0 = 1: Write parameters not authorized (EEPROM saving in progress) Bit 1 = 0: No parameter consistency check, drive controller locked at stop Bit 1 = 1: Parameter consistency check Bit 2 = 0: Fault reset not authorized Bit 2 = 1: Fault reset authorized Bit 3 = 0: No motor fluxing in progress (Type FVC only) Bit 3 = 1: Motor fluxing in progress (Type FVC only) Bit 4 = 0: Motor stopped Bit 4 = 1: Motor running Bit 5 = 0: No DC injection Bit 5 = 1: DC injection Bit 6 = 0: Drive controller running in steady state Bit 6 = 1: Drive controller running in transient state (ACC or DEC) Bit 7 = 0: No thermal overload alarm Bit 7 = 1: Thermal overload alarm Bit 8 = 0: No alarm if excessive braking Bit 8 = 1: Alarm if excessive braking Bit 9 = 0: Drive controller not accelerating Bit 9 = 1: Drive controller accelerating Bit 10 = 0: Drive controller not decelerating Bit 10 = 1: Drive controller decelerating Bit 11 = 0: No current limit alarm Bit 11 = 1: Current limit alarm Bit 12: Reserved Bit 14 = 0, Bit 13 = 0: Control via wired terminal strip Bit 14 = 0, Bit 13 = 1: Control via keypad display Bit 14 = 1, Bit 13 = 0: Control via standard serial link Bit 14 = 1, Bit 13 = 1: Control via fast serial link Bit 15 = 0: Forward direction of rotation requested (reference) Bit 15 = 1: Reverse direction of rotation requested (reference)
W460 or 16#5FE8/B	ETI2	Drive controller internal status register no. 2	Bit 0 = 0: Drive controller not in factory autotest mode Bit 0 = 1: Drive controller in factory autotest mode Bit 1 = 0: Drive controller not in board test mode Bit 1 = 1: Drive controller in board test mode Bit 2 = 0: Drive controller not in product test mode Bit 2 = 1: Drive controller in product test mode (burn-in) Bit 3 = 0: High speed not reached Bit 3 = 1: High speed reached Bit 4 = 0: Speed reference not reached Bit 4 = 1: Speed reference reached Bit 5 = 0: Frequency threshold (FTD) not reached Bit 5 = 1: Frequency threshold (FTD) reached Bit 6 = 0: Current threshold (CTD) not reached Bit 6 = 1: Current threshold (CTD) reached Bit 7 = 0: PID feedback correct (Type FVC only) Bit 7 = 1: PID feedback exceeded (Type FVC only) Bit 8 = 0: PID error correct (Type FVC only) Bit 8 = 1: PID error exceeded (Type FVC only) Bit 9 = 0: 4–20 mA signal OK Bit 9 = 1: Loss of 4–20 mA signal Bit 10 = 0: No drive thermal alarm Bit 10 = 1: Drive thermal alarm Bits 11 to 15: Reserved
W461 or 16#5FE8/C	ETI3	Drive controller internal status register no. 3	Bit 0 = 0: Drive controller power does not exceed 7.5 kW @ 230 V or 15 kW @ 400 V Bit 0 = 1: Drive controller power exceeds 7.5 kW @ 230 V and 15 kW @ 400 V Bit 1 = 0: Drive controller power does not exceed 30 kW @ 400 V or 15 kW @ 230 V Bit 1 = 1: Drive controller power exceeds 30 kW @ 400 V and 15 kW @ 230 V Bit 2 = 0: ATV58 Type H model Bit 2 = 1: ATV58 Type FVC model Bit 3 = 0: Overrating not allowed for lower power range model Bit 3 = 1: Overrating allowed for lower power range model (50/60 Hz switch on 60 Hz, caliber 3 kW @ 460 V to 15 kW @ 460 V, and CFG = VT) Bit 4 = 0: No extended VT ratings Bit 4 = 1: Extended VT ratings (ETI3 bit 3 = 1 and ORT = 1)

Altivar® 58 TRX AC Drives Communication Parameters

Monitoring Registers (Continued)

Word	Code	Description	Possible Values or Range
W462 or 16#5FE8/D	DP1	Past fault no. 1	0 = NOF: No fault saved 1 = INF: Internal fault 2 = EEF: EEPROM memory fault 3 = CFF: Configuration parameters incorrect (initialization) 4 = CFI: Configuration parameters invalid (if writing a configuration) 5 = SLF: Standard communication link fault (link break) 6 = ILF: Fast communication link fault (link break) 7 = CNF: Fast communication network fault 8 = EPF: External fault 9 = OCF: Overcurrent fault (prolonged ICL) 10 = CRF: Precharge relay fault 11 = SPF: Loss of speed feedback fault 12 = ANF: Ramp not followed fault 13 = LFF: Loss of follower fault (4–20 mA) 14 = TSF: Thermal sensor fault 15 = OTF: Motor overheating fault (thermal sensor) 16 = OHF: Drive controller overheating fault (on heatsink) 17 = OLF: Motor overload fault (thermal simulation or thermal sensor) 18 = OBF: DC bus overvoltage fault 19 = OSF: Input supply overvoltage fault 20 = OPF: Motor phase loss fault 21 = PHF: Input supply phase loss fault (> 1 s) 22 = USF: Input supply undervoltage fault (> 200 ms) 23 = SCF: Motor short circuit fault (phase to earth) 24 = SOF: Overspeed fault (with speed feedback: 1.11 x HSP; without feedback: 1.2 x TFR)
W463 or 16#5FE8/E	EP1	Status during past fault no. 1	Bit 0 = 0: Drive controller not ready Bit 0 = 1: Drive controller ready (RDY) Bit 1 = 0: E-stop (rapid deceleration) in progress Bit 1 = 1: E-stop (rapid deceleration) not in progress Bit 2 = 0: Status ≠ Switching Disabled Bit 2 = 1: Status = Switching Disabled (freewheel stop) Bit 3 = 0: Forced local active (FLO) Bit 3 = 1: Forced local inactive Bit 4 = 0: Forward rotation (output frequency) Bit 4 = 1: Reverse rotation (output frequency) Bit 5 = 0: Motor stopped Bit 5 = 1: Motor running Bit 6 = 0: No DC injection Bit 6 = 1: DC injection Bit 7 = 0: No thermal overload alarm Bit 7 = 1: Thermal overload alarm Bit 8 = 0: No excessive braking alarm Bit 8 = 1: Excessive braking alarm Bit 9 = 0: Drive controller not accelerating Bit 9 = 1: Drive controller accelerating Bit 10 = 0: Drive controller not decelerating Bit 10 = 1: Drive controller decelerating Bit 11 = 0: No current limit alarm Bit 11 = 1: Current limit alarm Bit 12: Reserved Bit 14 = 0, Bit 13 = 0: Control via wired terminal strip Bit 14 = 0, Bit 13 = 1: Control via keypad display Bit 14 = 1, Bit 13 = 0: Control via standard serial link Bit 14 = 1, Bit 13 = 1: Control via fast serial link Bit 15 = 0: Forward direction of rotation requested (reference) Bit 15 = 1: Reverse direction of rotation requested (reference)
W464 or 16#5FE8/F	DP2	Past fault no. 2	Same format as DP1 (W462 or 16#5FE8/13)
W465 or 16#5FE8/10	EP2	Status during past fault no. 2	Same format as EP1 (W463 or 16#5FE8/14)
W466 or 16#5FE8/11	DP3	Past fault no. 3	Same format as DP1 (W462 or 16#5FE8/13)
W467 or 16#5FE8/12	EP3	Status during past fault no. 3	Same format as EP1 (W463 or 16#5FE8/14)
W468 or 16#5FE8/13	DP4	Past fault no. 4	Same format as DP1 (W462 or 16#5FE8/13)
W469 or 16#5FE8/14	EP4	Status during past fault no. 4	Same format as EP1 (W463 or 16#5FE8/14)
W470 or 16#5FE8/15	DP5	Past fault no. 5	Same format as DP1 (W462 or 16#5FE8/13)
W471 or 16#5FE8/16	EP5	Status during past fault no. 5	Same format as EP1 (W463 or 16#5FE8/14)
W472 or 16#5FE8/17	DP6	Past fault no. 6	Same format as DP1 (W462 or 16#5FE8/13)
W473 or 16#5FE8/18	EP6	Status during past fault no. 6	Same format as EP1 (W463 or 16#5FE8/14)
W474 or 16#5FE8/19	DP7	Past fault no. 7	Same format as DP1 (W462 or 16#5FE8/13)
W475 or 16#5FE8/1A	EP7	Status during past fault no. 7	Same format as EP1 (W463 or 16#5FE8/14)

Monitoring Registers (Continued)

Word	Code	Description	Possible Values or Range
W476 or 16#5FE8/1B	DP8	Past fault no. 8	Same format as DP1 (W462 or 16#5FE8/13)
W477 or 16#5FE8/1C	EP8	Status during past fault no. 8	Same format as EP1 (W463 or 16#5FE8/14)

Monitoring Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W478 or 16#5FE8/1D	IOLR	—	State of logic I/O	Bit 0 = State of logic input LI1 (active at 1) Bit 1 = State of logic input LI2 (active at 1) Bit 2 = State of logic input LI3 (active at 1) Bit 3 = State of logic input LI4 (active at 1) Bit 4 = State of logic input LI5 (active at 1) Bit 5 = State of logic input LI6 (active at 1) Bits 6 and 7: Reserved Bit 8 = State of relay R1 (active at 1) Bit 9 = State of relay R2 (active at 1) Write authorized if R2 = No (not assigned) Bit 10 = State of logic output LO (active at 1) Write authorized if LO = No (not assigned) Bit 11 = State of red fault LED (active at 1) Bit 12 = State of precharge relay (active at 1) Bit 13 = State of dynamic brake transistor (active at 1) Bits 14 and 15: Reserved
W479 or 16#5FE8/1E	AI1R	0.001 V	State of analog input AI1 (actual size calibrated and scaled)	Value read
W480 or 16#5FE8/1F	AI2R	0.002 mA	State of analog input AI2 (actual size calibrated and scaled)	Value read 0 to 10000 = 0 to 20 mA
W481 or 16#5FE8/20	AI3R	0.001 V or 1	Voltage of analog input AI3 or number of pulses on encoder input, depending on type of I/O card	–10000 to +10000 (for VW3A58201U option card) or –32768 to 32767 (for VW3A58202U option card)
W482 or 16#5FE8/21	AOR	0.002 mA	Image of analog output AO	Write authorized if AO = No (not assigned) and option card is other than analog or digital I/O option 0 to 10000 = 0 to 20 mA Read only if assigned: Value read
W483 or 16#5FE8/22	DF1	—	Register of active faults no. 1 (no fault if bits = 0) Used only in manufacturing test. Do not use.	Bit 0 = 1: Incorrect calibration constants (INF) Bit 1 = 1: Unknown drive controller rating (INF) Bit 2 = 1: Unknown or incompatible option (INF) Bit 3 = 1: HD (ASIC) initialization incorrect (INF) Bit 4 = 1: EEPROM control board fault (EEF) Bit 5 = 1: EEPROM power board fault (EEF) Bit 6 = 1: Incorrect configuration (CFE) Bit 7 = 1: Invalid configuration (CFI) Bit 8 = 1: Standard communication link fault (SLF) Bit 9 = 1: Fast communication link fault (ILF) Bit 10 = 1: Fast communication network fault (CNF) Bit 11 = 1: External fault via standard serial link (EPF) Bit 12 = 1: External fault via fast serial link (EPF) Bit 13 = 1: Motor short circuit fault (SCF) Bit 14 = 1: Precharge relay closure too long (CRF) Bit 15 = 1: Precharge relay command cut-off (CRF)
W484 or 16#5FE8/23	DF2	—	Register of active faults no. 2 (no fault if bits = 0) Used only in manufacturing test. Do not use.	Bit 0 = 1: Speed feedback loss fault (SPF) Bit 1 = 1: Overspeed with speed feedback (SOF) Bit 2 = 1: Ramp not followed with speed feedback (ANF) Bit 3 = 1: Overcurrent fault (prolonged ICL) (OCF) Bit 4 = 1: Loss of follower (4–20 mA) fault (LFF) Bit 5 = 1: Thermal sensor fault (TSF) Bit 6 = 1: Motor overheating fault (thermal sensor) (OTF) Bit 7 = 1: Drive controller overheating fault (OHF) Bit 8 = 1: Motor overload fault (OLF) Bit 9 = 1: Fast communication time-out fault (CNF) Bit 10 = 1: DC bus overvoltage fault (OBF) Bit 11 = 1: Input supply overvoltage fault (OSF) Bit 12 = 1: Motor phase loss fault (OPF) Bit 13 = 1: Input supply phase loss fault (PHF) Bit 14 = 1: Input supply undervoltage fault (USF) Bit 15 = 1: Control board power supply fault (INF)
W485 or 16#5FE8/24	PPN	—	Number of motor pole pairs	Value read
W486 or 16#5FE8/25	CUS	—	I/O reassigned (Macro-configuration = CUS)	0 = No 1 = Yes
W487 or 16#5FE8/26	OTR	1% or 0.1%	Motor torque	Value read 100% corresponds to nominal motor torque
W488 or 16#5FE8/27	FRO	0.1 Hz	Ramp output (signed)	Value read

Altivar® 58 TRX AC Drives Communication Parameters

Monitoring Registers (Continued)

Word	Code	Units	Description	Possible Values or Range
W489 or 16#5FE8/28	USPL	0.01	Lower byte of machine speed	Value read
W490 or 16#5FE8/29	USPH	0.01	Upper byte of machine speed	Value read
W491 or 16#5FE8/2A	OPR	1%	Output power estimated by the drive controller	Value read 100% corresponds to nominal motor power
W492 or 16#5FE8/2B	AO1R	0.002 mA	Image of analog output AO1.	Write authorized if AO1 = No (not assigned): 0 to 10000 (0 to 20 mA) Read only if assigned: Value read
W493 or 16#5FE8/2C	UOP	0.1 V	Voltage applied to the motor. Exists only on Type FVC models.	Value read
W494 or 16#5FE8/2D	APH	1 kWh or 1 MWh	Drive power meter (kWh)	Value read. If bit 15 = 0, units are kWh as given by bits 0 to 14. If bit 15 = 1, units are MWh as given by bits 0 to 14.
W495 or 16#5FE8/2E	RTH	1 hr	Total motor run time	Value read

Special DRIVECOM Registers

Word	Code	Units	Parameter Name and Description	Possible Values or Range
W600 or 16#603F	ERRD	—	ErrorCode Fault code Read/Write	16#0 = NOF: No fault 16#1000 = CRF: Pre-charge relay fault or = OLF: Motor overload (calculation or PTC probes) or = SOF: Overspeed 16#2310 = OCF: Overcurrent (prolonged LIC) 16#2320 = SCF: Motor short-circuit (phase/earth) 16#3110 = OSF: Line supply overvoltage 16#3120 = USF: Line supply undervoltage (> 200 ms) 16#3130 = PHF: Line supply phase loss (> 1s) 16#3310 = OBF: DC bus overvoltage or = OPF: Motor phase loss 16#4210 = OHF: Drive overheating (heatsink) 16#4310 = OTF: Motor overheating (PTC probes) 16#5520 = EEF: EEPROM memory fault 16#6100 = INF: Internal fault 16#6300 = CFF: Configuration incorrect (on initialization) or = CFI: Configuration invalid (if writing a configuration) 16#7300 = ANF: Ramp not followed or = LFF: Loss of 4–20 mA signal or = TSF: Thermal sensor fault 16#7310 = SPF: Speed feedback missing or miswired 16#7510 = SLF: Serial link fault—keypad port (link break) 16#7520 = ILF: Fast serial link fault—options port (link break) or = CNF: Fast serial link communication network fault 16#9000 = EPF: External fault
W601 or 16#6040	CMDD	—	Controlword Command word—same as parameter CMD Read/Write	
W602 or 16#6041	ETAD	—	Statusword Status word—same as parameter ETA Write prohibited	
W603 or 16#6042	LFRD	1 rpm ^[1]	SpeedSetP Speed reference in rpm (reference not peak limited) Read/Write	–32768 to 32767
W604 or 16#6043	FRHD	1 rpm	SpeedRef Ramp output (signed) in rpm Write prohibited	
W605 or 16#6044	RFRD	1 rpm ^[1]	SpeedActV Motor speed in rpm Write prohibited	
W606 or 16#6046/1	SMIL	1 rpm	SpdMinMax Minimum speed in 32 bits Equivalent to LSP (W251), but in rpm Read/Write	0 to HSP
W607	SMIH		Reserved	0
W608 or 16#6046/2	SMAL	1 rpm	SpdMinMax Maximum speed in 32 bits Equivalent to HSP (W250), but in rpm Read/Write	LSP to TFR
W609	SMAH	—	Reserved	0

[1] For ATV58 Type FVC, if CMI Bit 9 = 0, units are in rpm; if CMI Bit 9 = 1, units are in 0.015 Hz.

Special DRIVECOM Registers (Continued)

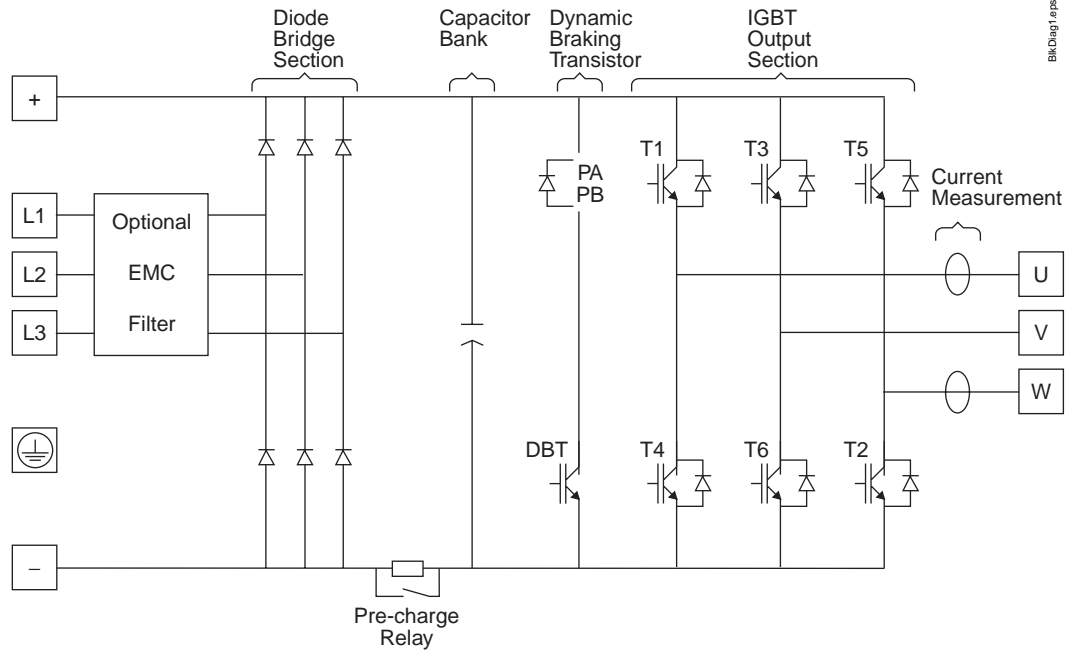
Word	Code	Units	Parameter Name and Description	Possible Values or Range
W610 or 16#6048/1	SPAL	1 rpm	SpdAcc Acceleration ramp determined by a speed variation in rpm via words W610 and W611 (32 bits) plus a time variation in seconds given by word W612 (16 bits) Read/Write	1 to 65535
W611	SPAH	—	Reserved	0
W612 or 16#6048/2	SPAT	1 s	SpdAcc Acceleration ramp determined by a speed variation in rpm via words W610 and W611 (32 bits) plus a time variation in seconds given by word W612 (16 bits) Read/Write	0 to 65535
W613 or 16#6049/1	SPDL	1 rpm	SpdDec Deceleration ramp determined by a speed variation in rpm via words W613 and W614 (32 bits) plus a time variation in seconds given by word W615 (16 bits) Read/Write	1 to 65535
W614	SPDH	—	Reserved	0
W615 or 16#6049/2	SPDT	1 s	SpdDec Deceleration ramp determined by a speed variation in rpm via words W613 and W614 (32 bits) plus a time variation in seconds given by word W615 (16 bits) Read/Write	0 to 65535

Altivar® 58 TRX AC Drives

Power Section Construction Information

POWER SECTION CONSTRUCTION INFORMATION

**Block Diagram for ATV58HU09M2 to ATV58HD12M2 (0.5 to 10 hp, 208/230 Vac) and
ATV58HU18N4 to ATV58HD23N4 (1 to 20 hp, 400/460 Vac)**



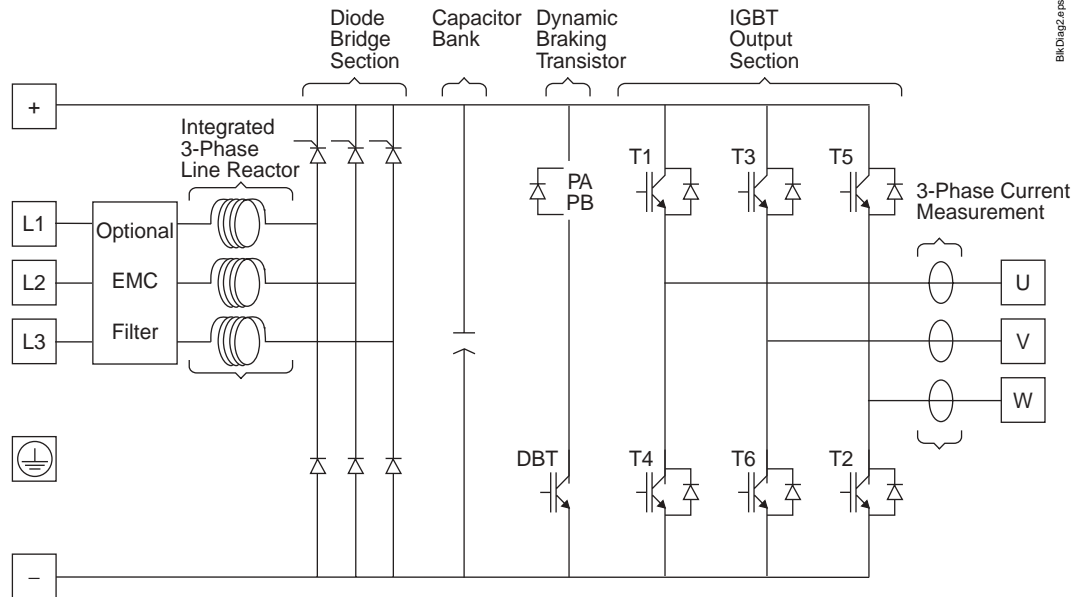
The block diagram above provides an overview of the construction of the ATV58 TRX drive controller power section. The drive controllers in the horsepower ranges referenced above are built in five frame sizes. (See the dimensional drawings on pages 120 to 122.) The various frame sizes share in common many components and technological advances:

- In frame size 1, the diode bridge section and the insulated gate bipolar transistor (IGBT) output section are integrated into one module. The dynamic braking module is purchased and mounted separately. All other frame sizes have the dynamic brake switching module internal to the product.
- In frame sizes 2 and 3, the diode bridge section, the IGBT output section, and the dynamic braking components are integrated into one module.
- In frame sizes 4 and 5, the diode bridge section is one module. The IGBT output section is integrated into a power module (PM). The dynamic braking transistor is incorporated into the diode bridge section or the power module, depending on the rating.
- The EMC filter is optional on frame sizes 3, 4, and 5.

Integration reduces the part count and the wiring and connection points required to connect components. The output section has fault detection and short circuit protection of the output transistors integrated into the module. The use of these modules eliminates individual gate drive cards and associated wiring as used by most other manufacturers in this horsepower range. These features combine to make the Altivar 58 TRX drive fit in a smaller package while improving the reliability of the product.

Altivar® 58 TRX AC Drives Power Section Construction Information

**Block Diagram ATV58HD16M2 to ATV58HD46M2 (15 to 40 hp/50 hp VT 208/230 Vac) and
ATV58HD28N4 to ATV58HD79N4 (25 to 75 hp/100 hp VT 400/460 Vac)**



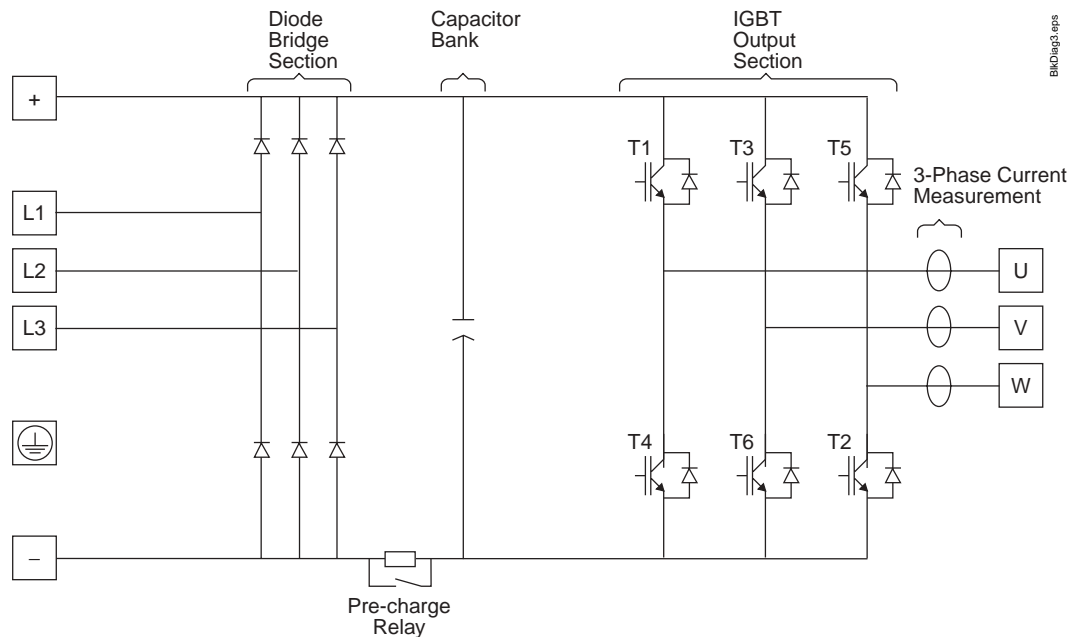
The block diagram above provides an overview of the construction of the ATV58 TRX drive controller power section. The drive controllers in the horsepower ranges referenced above are built in frame sizes 6 and 7. (See the dimensional drawings on pages 120 to 122.) These two frame sizes share many components and technological advances:

- The option of having an input EMC filter mounted integrally in the product.
- An internally-mounted 3-phase line reactor.
- The diode bridge section consists of three modules each containing a diode and a thyristor. This advanced diode/thyristor module is ASIC-controlled to gate on the thyristor to charge the DC bus when power is initially applied to the unit. Once the DC bus is charged, the thyristor is gated on full time and acts as a diode. This technological advance allows for elimination of the electromechanical precharge relay. This improves product reliability and allows for reduced package size.
- The dynamic braking components are incorporated into one module, internally mounted in the product.
- The output section consists of six insulated gate bipolar transistors (IGBTs) integrated into the power module (PM). Frame size 6 integrates the six IGBTs into one power module, while frame size 7 contains three power modules with two integrated IGBTs each.
- Three current sensors are used on the output to monitor the current supplied to the motor. The feedback from these sensors is used by the motor control algorithms.

Integration reduces the part count and the wiring and connection points required to connect components. The power modules provide further integration by combining fault detection and short circuit protection of the output transistors. The use of power modules also eliminates individual gate drive cards and associated wiring used by most other manufacturers in this horsepower range. The drive also incorporates a laminated bus network of power conductors for line, DC bus, and motor power with connections made with screws instead of traditional cable connectors. These factors combine to make the product fit in a smaller package while improving the reliability of the product.

Altivar® 58 TRX AC Drives Power Section Construction Information

Block Diagram for ATV58HC10N4X to ATV58HC33N4X (125 to 500 hp, 400/460 Vac)



The block diagram above provides an overview of the construction of the ATV58 TRX drive controller power section. The horsepower ranges of the drives referenced above are built in three frame sizes, 8, 9, and 10. (See the dimensional drawings on pages 120 to 122.) Common frame sizes share many components:

- The diode bridge section in these frame sizes consists of three modules (frame sizes 8 and 9) or six modules (frame size 10). Each module contains a pair of diodes.
- There is no dynamic braking transistor built into these frame sizes.
- The output section consists of insulated gate bipolar transistors (IGBTs) integrated into power modules. These frame sizes contain modules which have two integrated IGBTs each.
- Three current sensors are used on the output to monitor the current supplied to the motor. The motor control algorithms use the feedback from these sensors.

Integration reduces the part count which allows for smaller package size while increasing the reliability of the product. The power modules provide integration by combining fault detection and over current protection with the transistor. One single gate driver card is used instead of six individual gate driver cards used by most other manufacturers in this horsepower range. These factors combine to make the product fit in a smaller package and improve the reliability of the product.

Altivar® 58 TRX AC Drives Performance Information (Constant Torque Rated Products)

PERFORMANCE INFORMATION (CONSTANT TORQUE RATED PRODUCTS)

Schneider Electric/Square D has made continuous improvements in the algorithms used by the ATV58 TRX drives to regulate the torque and speed of AC motors. As a result, ATV58 TRX drive controllers deliver superior speed regulation and torque performance allowing them to be applied in many applications that formerly used DC drives and DC motors.

Using the ATV58 TRX drive controller and an AC motor in place of a DC drive and DC motor can reduce the installed cost, reduce maintenance costs, and provide improved performance:

- Mounting space is reduced because AC motors have smaller frame sizes and weigh less than DC motors of equal horsepower.
- Unlike DC motors, AC motors are manufactured in standard frame sizes, providing greater flexibility in motor replacement.
- AC motors are available in TENV (totally enclosed, non-ventilated) frames making them more suitable for harsh environments.
- AC motors can provide a higher speed range which may eliminate the need for external gearing.
- AC motors have lower rotor inertia allowing a faster response when used with the ATV58 TRX drive controller.
- AC motors have lower maintenance costs because they do not have brushes or commutators like DC motors.
- The ATV58 TRX drive controller operating in open loop mode may offer sufficient performance eliminating the installation cost and maintenance of a tachometer or encoder.
- Component cost of the ATV58 TRX drive and AC motor is less than a comparable DC drive and DC motor.

In open loop mode, the ATV58 TRX drive controller uses a sensorless vector control algorithm to control the motor. Option cards are also available that provide connections for tachometer or quadrature encoder feedback for closed loop operation.

In open loop mode, the ATV58 TRX vector control algorithm provides:

- An improved level of transient torque.
- Improved speed regulation with static and dynamic loading.
- More than rated torque at low speed.

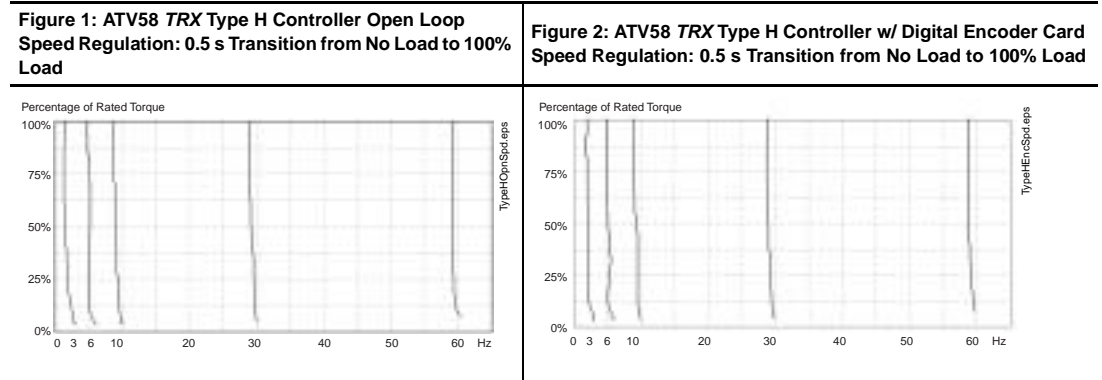
The vector control algorithm separates motor current into two components: the magnetizing current needed to establish the magnetic field, or flux, in the motor and the current that is used to produce motor torque. This allows the flux and the torque to be controlled independently. The vector control algorithm uses DC bus voltage measurements, motor current feedback, and motor model information as inputs to control the applied voltage, phase rotation of the applied voltage, and frequency supplied to the motor. This allows the ATV58 TRX drive to maintain constant flux in the motor, compensate for motor slip, and provide motor torque control.

Altivar® 58 TRX AC Drives

Speed Regulation (Constant Torque Rated Products)

SPEED REGULATION (CONSTANT TORQUE RATED PRODUCTS)

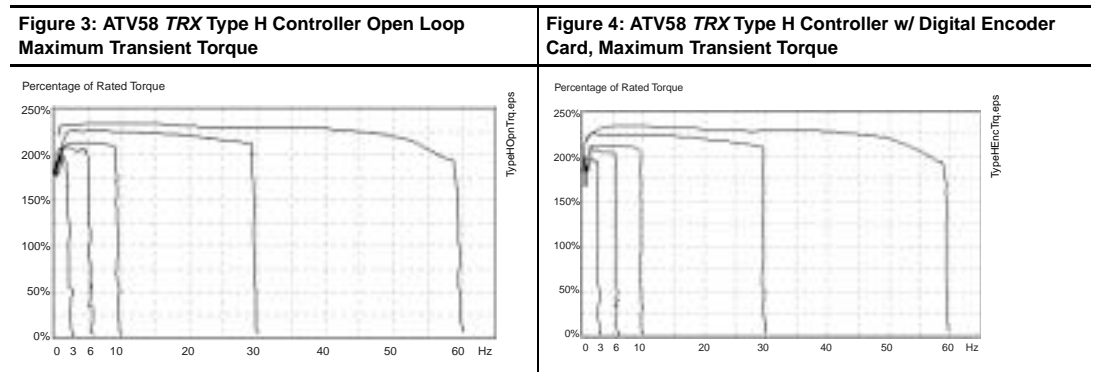
Figures 1 and 2 are speed/torque plots of an ATV58 TRX Type H controller operating in constant torque mode with an off-the-shelf AC motor operating in open loop mode (without an encoder or tachometer feedback from the motor) and in closed loop mode (with a 1024 pulse per revolution encoder feedback from the motor). To demonstrate the speed regulation capabilities, these plots were generated by operating the drive from no load at zero speed to full load at various speeds. The autotune feature was configured. The gain parameter was adjusted to 50% and the stability parameter was adjusted to 50%. Note the speed regulation capability of the ATV58 TRX drive controller as exhibited by the portion of the speed torque curve that is nearly perpendicular to the Y-axis.



Maximum Transient Torque

Figures 3 and 4 are speed/torque plots of an ATV58 TRX Type H drive controller operating in constant torque mode with an off-the-shelf AC motor operating in open loop mode (without an encoder or tachometer feedback from the motor) and in closed loop mode (with a 1024 pulse per revolution encoder feedback from the motor). To demonstrate the torque producing capabilities, these plots were generated by operating the drive from no load at zero speed to maximum transient torque at various speeds. The autotune feature was configured. The gain parameter was adjusted to 50% and the stability parameter was adjusted to 50%. The available overtorque is a function of the motor design category. For typical NEMA Design B motors, the ATV58 TRX controller can deliver 200% of the nominal motor torque for 2 seconds, and 170% for 60 seconds.

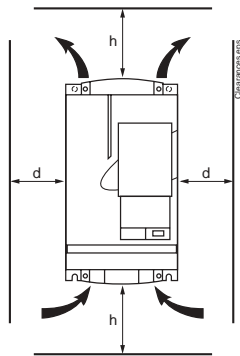
Note the 200% transient torque produced by the ATV58 TRX Type H model, and note the torque producing capabilities at very low speeds.



Operation in overspeed:

- In overspeed operation, the voltage no longer increases with the frequency, resulting in reduced induction in the motor which results in loss of torque. Consult the motor manufacturer to ensure that the motor can operate in overspeed.
- For a special motor, the nominal frequency and the maximum frequency can be adjusted between 10 and 500 Hz using the keypad display, PowerSuite, or Commissioning software.

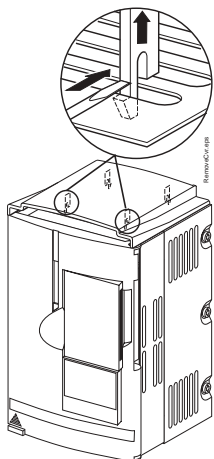
INSTALLATION RECOMMENDATIONS



h = 50 mm (2 in) for:
HU09M2 to HU72M2
HU18N4 to HU90N4
HU90M2 to HD12M2
HD12N4 to HD23N4

h = 100 mm (4 in) for:
HD16M2X to HD46M2X
HD28N4 to HD79N4
HD28N4X to HD79N4X
HC10N4X to HC33N4X

Minimum Clearances



Removing the Protective Cover

- The ATV58 TRX drive controller must be installed in a suitable environment. The environment around the drive controller must not exceed pollution degree requirements as defined in NEMA ICS-1 Appendix A or EN60664/IEC60664.
- Install the drive controller vertically ($\pm 10^\circ$) with the power terminals at the bottom. Avoid placing the drive controller near any heat sources.
- Installation of a disconnect switch between the input line and the drive controller should be in accordance with national and local codes.
- Overcurrent protection is required. Refer to page 113 for recommended fuses.
- The figure to the left shows the minimum clearances required around each drive controller for unobstructed air flow. Also, leave at least 0.4 in. (10 mm) in front of the drive controller. These clearances should not be used as minimum enclosure size for proper thermal dissipation.

Depending on the ambient temperatures in which the ATV58 TRX controller is used, the clearance on the sides of the controller (dimension d in the drawing), and the particular ATV58 TRX model, removal of the protective cover or adding a fan may be required; see the table below for more information.

ATV58 TRX Model	Dimension d	Temperature		
		-10 to +40°C (14 to 104 °F)	40 to 50°C (104 to 122 °F)	50 to 60°C (122 to 140 °F)
HU09M2 to HU72M2 HU18N4 to HU90N4	≥ 50 mm (2 in)	No special precautions needed.	Remove the protective cover from the top of the controller (see graphic to the left). Degree of protection becomes IP20.	Add control card fan kit VW3A5882* (see page 33 for more information) and derate the rated operating current by 2.2% for each °C over 50 °C.
	< 50 mm (2 in)	Remove the protective cover from the top of the controller (see graphic to the left). Degree of protection becomes IP20.	Add control card fan kit VW3A5882* (see page 33 for more information).	Unacceptable mounting clearance.
HU90M2 to HD12M2 HD12N4 to HD23N4	≥ 50 mm (2 in)	No special precautions needed.	Remove the protective cover from the drive (see graphic to the left). Degree of protection becomes IP20. Also derate the rated operating current by 2.2% for each °C over 40 °C.	Do not install where the ambient temperature exceeds 50 °C (122 °F).
	< 50 mm (2 in)	Remove the protective cover from the top of the controller (see graphic to the left). Degree of protection becomes IP20.	Add control card fan kit VW3A5882* (see page 33 for more information) and derate the rated operating current by 2.2% for each °C over 40 °C.	Do not install where the ambient temperature exceeds 50 °C (122 °F).
HD16M2X to HD46M2X HD28N4 to HD79N4 HD28N4X to HD79N4X	≥ 50 mm (2 in)	No special precautions needed.	Add control card fan kit VW3A5882* (see page 33 for more information) and derate the rated operating current by 2.2% for each °C over 40 °C.	Do not install where the ambient temperature exceeds 50 °C (122 °F).
	< 50 mm (2 in)	Unacceptable mounting clearance.	Unacceptable mounting clearance.	Unacceptable mounting clearance.
HC10N4X to HC33N4X	< 50 mm (2 in)	No special precautions needed.	Do not install where the ambient temperature exceeds 40 °C (109 °F).	Do not install where the ambient temperature exceeds 50 °C (122 °F).

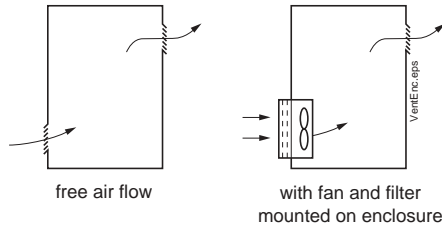
Altivar® 58 TRX AC Drives

Installation Recommendations

Mounting in a General-Purpose Metal Enclosure

To ensure sufficient air circulation when mounting an ATV58 TRX drive in a general-purpose enclosure, observe the following:

- Provide ventilation inlets and outlets in the enclosure (see the figure below).



- If the enclosure does not provide sufficient free air flow, install an enclosure ventilation fan with IP54/NEMA 12 filters to exhaust heat outside of the enclosure (see the figure above). The enclosure fan should have a greater fan flow rate than the drive controller fan flow rate listed in the table below.

ATV58 TRX Model	Fan Flow Rate	
ATV58HU09M2, ATV58U18M2	Non-Ventilated	
ATV58HU29M2, ATV58U18N4, ATV58U29N4, ATV58U41N4, ATV58U54N4	36 m ³ /hour	21 CFM
ATV58HU41M2	47 m ³ /hour	27.5 CFM
ATV58HU54M2, ATV58U72M2, ATV58U54N4, ATV58U72N4, ATV58U90N4	72 m ³ /hour	42 CFM
ATV58HU90M2, ATV58D12M2, ATV58D12N4, ATV58D16N4, ATV58D23N4	72 m ³ /hour	42 CFM
ATV58HD16M2, ATV58D23M2, ATV58D28N4, ATV58D33N4, ATV58D46N4	161 m ³ /hour	94 CFM
ATV58HD28M2, ATV58D33M2, ATV58D46M2, ATV58D54N4, ATV58D64N4, ATV58D79N4	343 m ³ /hour	200 CFM
ATV58HC10N4X	600 m ³ /hour	350 CFM
ATV58HC13N4X, C15N4X, C19N4X	900 m ³ /hour	525 CFM
ATV58HC23N4X, C25N4X, C28N4X, C31N4X, C33N4X	900 m ³ /hour	525 CFM

- If there is a possibility of condensation, keep the control supply switched on during periods when the motor is not running, or install thermostatically controlled strip heaters.

Mounting in a Type 12 or IP54 Metal Enclosure

Certain conditions may require Type 12 or IP54 protection, such as dust, corrosive gas, high humidity with the risk of condensation and dripping water. When mounting in a Type 12 or IP54 enclosure, follow the installation recommendations given on page 97.

If the enclosure is non-ventilated, use a stirring fan to circulate the air inside the enclosure to prevent hot spots from forming. With a stirring fan, the maximum temperature inside the enclosure can then be up to 60 °C (140 °F), although the current must be derated by 2.2% per °C above 50 °C. If condensation might form within the enclosure, keep the power supply switched on during periods when the motor is not running, or install thermostatically controlled strip heaters.

Calculating Enclosure Size

The equation for calculating R_{th} ($^{\circ}\text{C}/\text{W}$), the maximum allowable thermal resistance of the enclosure, is:

$$R_{th} = \frac{T_i - T_o}{P}$$

T_i = Max. internal ambient temp. ($^{\circ}\text{C}$) around drive controller
 T_o = Max. external temp. ($^{\circ}\text{C}$) around enclosure
 P = Total power dissipated in enclosure (W)

Useful heat exchange surface area, S (in^2), of a wall-mounted enclosure generally consists of the sides, top, and front. The minimum surface area required for a drive controller enclosure is calculated as follows.

NOTE: Contact enclosure manufacturer for K factors.

$$S = \frac{K}{R_{th}}$$

R_{th} = Thermal resistance of the enclosure (calculated previously)
 K = Thermal resistance per square inch of the enclosure.

Consider the following points when sizing the enclosure:

- Use only metallic enclosures since they have good thermal conduction.
- This procedure does not consider radiant or convected heat load from external sources. Do not install enclosures where external heat sources (such as direct sunlight) can add to enclosure heat load.
- If additional devices are present inside the enclosure, consider the heat load of the devices in the calculation.
- The actual useful area for convection cooling of the enclosure will vary depending upon the method of mounting. The method of mounting must allow for free air movement over all surfaces considered for convection cooling.

The following example illustrates calculation of the enclosure size for an ATV58HU29N4 (2 HP) drive controller mounted in a Type 12 enclosure.

- Maximum external temperature: $T_o = 25^{\circ}\text{C}$
- Power dissipated inside enclosure: $P = 97\text{ W}$ (from ratings tables; see page 10)
- Maximum internal temperature: $T_i = 40^{\circ}\text{C}$
- Thermal resistance per square inch of enclosure: $K = 186$
- Calculate maximum allowable thermal resistance, R_{th} :

$$R_{th} = \frac{40^{\circ}\text{C} - 25^{\circ}\text{C}}{97\text{ W}} = 0.16^{\circ}\text{C}/\text{W}$$

- Calculate minimum useful heat exchange surface area, S :

$$S = \frac{186}{0.16} = 1162.5\text{ in}^2$$

Useful heat exchange surface area (S) of the proposed wall-mounted enclosure:

- Height: 24 in (610 mm)
- Width: 20 in (508 mm)
- Depth: 12 in (305 mm)

$$S = \begin{matrix} \text{front area} & \text{top area} & \text{side area} \\ \downarrow & \downarrow & \downarrow \\ (24 \times 20) & + (20 \times 12) & + 2(24 \times 12) \end{matrix} = 1296\text{ in}^2$$

Since the surface area of the enclosure is greater than the minimum required surface area (1162.5 in^2), the enclosure is sufficiently large for this particular ATV58 TRX model.

Note that if the selected enclosure did not provide the required surface area or did not meet application needs, then the following would need to be considered:

- Use a larger enclosure.
- Add a passive heat exchanger to the enclosure.
- Add an air conditioning unit to the enclosure.

Altivar® 58 TRX AC Drives Wiring Recommendations

WIRING RECOMMENDATIONS

Good wiring practice requires the separation of control circuit wiring from all power wiring. Power wiring to the motor must have the maximum possible separation from all other power wiring, whether from the same drive controller or other drive controllers; **do not run power and/or control or multiple power wiring in the same conduit.** This separation reduces the possibility of coupling electrical transients from power circuits into control circuits or from motor power wiring into other power circuits.

Follow the practices below when wiring enclosed ATV58 TRX drive controllers:

- When using metallic conduit, use metal conduit kits; see page 33 for a list of conduit kits.
- Use metallic conduit for all controller wiring.
- Do not run control and power wiring in the same conduit.
- Do not run output wiring from more than one drive in the same conduit.
- Separate metallic conduits carrying power wiring or low-level control wiring by at least 3 in. (76 mm).
- Separate non-metallic conduits or cable trays used to carry power wiring from metallic conduit carrying low-level control wiring by at least 12 in. (305 mm).
- Whenever power and control wiring cross, the metallic conduits and non-metallic conduits or trays must cross at right angles.
- Equip all inductive circuits near the drive (relays, contactors, solenoid valves) with noise suppressors or connect them to a separate circuit.

Recommendations for Wire Sizing

Refer to NEC Article 430 for the sizing of the branch circuit conductors. All branch circuit components and equipment (such as transformers, feeder cables, disconnect devices, and protective devices) must be rated for the input current of the ATV58 TRX drive controller or the rated output current, whichever value is larger. **The input current of the controller depends on the impedance of the power distribution system and the available fault current at the drive input terminals.**

Select the input current corresponding to the available short circuit current capability (AIC Rating) or the line impedance present. If the available fault current capability of the branch circuit is limited by fuses or circuit breakers (not system impedance), use the available fault current capability on the line side of the fuses or circuit breakers to select the drive controller input current. The input current values for the variable torque drive controller ratings are based on nominal NEC rated motor currents. The input current values for the constant torque drive controller ratings are based on drive controller rated output currents. The tables on the following pages provide input current information to optimally size branch circuit conductors.

Altivar® 58 TRX AC Drives Wiring Recommendations

Ratings for Input Line Currents, Type H Constant Torque 208/230 Vac Single-Phase Input with Three-Phase Output, Switching Frequency at 4 kHz

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected based on the rated controller output current.

Drive Controller Catalog Number	Motor Power 208/230 Vac		Rated Output Current In	Input Line Current							
				2000 AIC		5000 AIC		22000 AIC		w/ Additional 3% Line Impedance 22000 AIC	
	kW	HP	A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A
ATV58HU09M2•	0.37	0.5	2.3	5.6	4.7	—	—	—	—	4.2	3.8
ATV58HU18M2•	0.75	1	4.1	9.8	8.3	—	—	—	—	7.9	7
ATV58HU29M2•	1.5	2	7.8	—	—	18.5	15.6	—	—	14.1	12.3
ATV58HU41M2•	2.2	3	11	—	—	25.6	21.6	—	—	20.5	17.5
ATV58HU72M2•	3	4	13.7	—	—	25.1	22.7	—	—	23.3	20.6
ATV58HU90M2•	4	5	18.2	—	—	27.5	24.8	30.7	27.6	32.3	28.6
ATV58HD12M2•	5.5	7.5	24.2	—	—	39.8	36.6	44.9	40	42.5	37.6

Ratings for Input Line Currents, Type H Variable Torque Low Noise 208/230 Vac Single-Phase Input with Three-Phase Output, Switching Frequency: ATV58HU09M2 to D12M2 at 8kHz, ATV58HD16M2 to D46M2 at 4 kHz

Drive Controller Catalog Number	Motor Power 208/230 Vac		Rated Output Current In	Input Line Current							
				2000 AIC		5000 AIC		22000 AIC		w/ Additional 3% Line Impedance 22000 AIC	
	kW	HP	A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A
ATV58HU09M2•	0.37	0.5	2.3	5.6	4.7	—	—	—	—	4.2	3.8
ATV58HU18M2•	0.75	1	4.8	9.8	8.3	—	—	—	—	7.9	7
ATV58HU29M2•	1.5	2	7.8	—	—	18.5	15.6	—	—	14.1	12.3
ATV58HU41M2•	2.2	3	11	—	—	25.6	21.6	—	—	20.5	17.5
ATV58HU72M2•	3	4	14.3	—	—	25.1	22.7	—	—	23.3	20.6
ATV58HU90M2•	4	5	17.5	—	—	27.5	24.8	35	30	32.3	28.6
ATV58HD12M2•	5.5	7.5	25.3	—	—	39.8	36.6	46	39.4	42.5	37.6
ATV58HD16M2• ^[1]	7.5	10	30.8	—	—	—	—	—	—	60	53
ATV58HD23M2• ^[1]	11	15	46.2	—	—	—	—	—	—	86	76
ATV58HD28M2• ^[1]	15	20	60	—	—	—	—	—	—	115	102
ATV58HD33M2• ^[1]	18.5	25	75	—	—	—	—	—	—	141	125
ATV58HD46M2• ^[1]	22	30	88	—	—	—	—	—	—	168	149

[1] A 3% line reactor must be used when supplied with single phase input.

Ratings for Input Line Currents, Type H Constant Torque 208/230 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58HU29M2 to D23M2 at 4kHz, ATV58HD28M2 to D46M2 at 2 kHz

Drive Controller Catalog Number	Motor Power 208/230 Vac		Rated Output Current In	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance 22000 AIC	
	kW	HP	A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A
ATV58HU29M2•	1.5	2	7.8	9.7	8.3	—	—	—	—	6.6	5.9
ATV58HU41M2•	2.2	3	11	13.4	11.4	—	—	—	—	9.5	8.5
ATV58HU54M2•	3	4	13.7	17.2	15	—	—	—	—	12.6	11.2
ATV58HU72M2•	4	5	18.2	22.4	19.5	—	—	—	—	16.9	14.6
ATV58HU90M2•	5.5	7.5	24.2	30	26.4	32.1	28.4	34.7	30	23.3	20.6
ATV58HD12M2•	7.5	10	31	39.7	35	42.3	37.4	44.4	38.2	32.3	28.6
ATV58HD16M2•	11	15	47	42.4	43.1	42.8	43.3	43.4	43.6	43.4	43
ATV58HD23M2•	15	20	60	58	58.5	58.2	58.3	58.5	58.7	58.5	58.7
ATV58HD28M2•	18.5	25	75	70.2	70.4	70.6	70.4	70.2	70.4	69.4	70
ATV58HD33M2•	22	30	88	82.3	82.7	82.5	83.9	84	84	83.2	83.6
ATV58HD46M2•	30	40	116	100.8	102.2	101.2	103.2	101.7	101.5	101.7	103.7

Altivar® 58 TRX AC Drives

Wiring Recommendations

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected based on the rated controller output current.

Ratings for Input Line Currents, Type H Variable Torque 208/230 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58HU29M2 to D23M2 at 4 kHz, ATV58HD28M2 to D46M2 at 2 kHz

Drive Controller Catalog Number	Motor Power 208/230 Vac		Rated Output Current In A	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance	
	kW	HP		208 V A	230 V A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A
ATV58HU29M2•	1.5	2	7.5	9.4	8.6	—	—	—	—	6.6	5.9
ATV58HU41M2•	2.2	3	10.6	13	11.8	—	—	—	—	9.5	8.5
ATV58HU54M2•	3	4	14.3	17.2	15	—	—	—	—	12.6	11.2
ATV58HU72M2•	4	5	16.7	21.4	19.5	—	—	—	—	16.9	14.6
ATV58HU90M2•	5.5	7.5	24.2	29	26.4	32.1	28.4	34.7	30	23.3	20.6
ATV58HD12M2•	7.5	10	30.8	38.3	35	42.3	37.4	44.4	38.2	32.3	28.6
ATV58HD16M2•	11	15	46.2	41.7	37.8	41.7	38	41.7	38	41.7	38
ATV58HD16M2•	15	20	60	55.5	50.5	55.7	50.5	55.7	50.8	55.1	50.5
ATV58HD23M2•	18.5	25	75	67	61.8	67.2	61.8	67.2	61.8	67.1	61.4
ATV58HD28M2•	22	30	88	80.5	73.3	80.6	73.3	80.9	73.6	80.7	73.6
ATV58HD33M2•	30	40	116	107.6	97.9	108.4	97.9	108.4	98.5	107.6	98.5
ATV58HD46M2•	37	50	143	134.8	121.2	135.4	121.2	135.5	124	135	123.7

Ratings for Input Line Currents, Type H Variable Torque Low Noise 208/230 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58HU29M2 to D23M2 at 8 kHz, ATV58HD28M2 to D46M2 at 4 kHz

Drive Controller Catalog Number	Motor Power 208/230 Vac		Rated Output Current In A	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance	
	kW	HP		208V A	230 V A	208 V A	230 V A	208 V A	230 V A	208 V A	230 V A
ATV58HU29M2•	1.5	2	7.5	9.4	8.6	—	—	—	—	6.6	5.9
ATV58HU41M2•	2.2	3	10.6	13	11.8	—	—	—	—	9.5	8.5
ATV58HU54M2•	3	4	14.3	17.2	15	—	—	—	—	12.6	11.2
ATV58HU72M2•	4	5	16.7	21.4	19.5	—	—	—	—	16.9	14.6
ATV58HU90M2•	5.5	7.5	24.2	29	26.4	32.1	28.4	34.7	30	23.3	20.7
ATV58HD12M2•	7.5	10	30.8	38.3	35	35.7	32.4	35.8	32.8	35.2	32.8
ATV58HD16M2•	11	15	46.2	42.7	39	42.7	39	42.7	39	42.4	39
ATV58HD23M2•	15	20	60	55.2	48.9	55.2	50.5	55.4	51.2	55.4	50.7
ATV58HD28M2•	18.5	25	75	67.8	61.9	68.2	62.1	68.4	62.6	67.6	61.6
ATV58HD33M2•	22	30	88	82	73.8	82	75.1	82.8	76.7	82.8	76.5
ATV58HD46M2•	30	40	116	108.6	97.3	109.2	99.2	109.7	99.7	109.4	99.7

Altivar® 58 TRX AC Drives Wiring Recommendations

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected based on the rated controller output current.

Ratings for Input Line Currents, Type H and Type FVC Constant Torque 400/460 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58•U18N4 to D46N4 at 4 kHz, ATV58•D54N4 to D79N4 at 2 kHz

Drive Controller Catalog Number	Motor Power		Rated Output Current In A	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance	
	400 V kW	460 V HP		400 V A	460 V A	400 V A	460 V A	400 V A	460 V A	400 V A	460 V A
ATV58HU18N4•	0.75	1	2.3	3.4	2.6	—	—	—	—	1.9	1.6
ATV58HU29N4•	1.5	2	4.1	6	4.5	—	—	—	—	3.3	3
ATV58HU41N4•	2.2	3	5.8	7.8	6	—	—	—	—	4.8	4.2
ATV58HU54N4•	3	4	7.8	10.2	7.8	—	—	—	—	6.3	5.6
ATV58HU72N4•	4	5	10.5	13	10.1	—	—	—	—	8.6	7.2
ATV58HU90N4•	5.5	7.5	13	17	13.2	—	—	—	—	11.8	10.1
ATV58HD12N4•	7.5	10	17.6	20.7	18.2	22.7	19.9	26.5	21	16	13.2
ATV58HD16N4•	11	15	24.2	28.8	25.3	31.4	27.6	35.4	28	23.6	19.5
ATV58HD23N4•	15	20	33	36.5	32	39.6	34.7	44.7	35.6	30.6	25.8
ATV58HD28N4•	18.5	25	40.7	37.3	38.3	37.9	39.2	38.9	40.1	38.7	40
ATV58HD33N4•	22	30	48.4	44.4	44.8	45.9	46.7	46.5	47.6	46.4	47.6
ATV58HD46N4•	30	40	66	59.1	59.9	61.2	61.9	62	61.9	62.1	63.7
ATV58HD54N4•	37	50	79.2	70.6	71.4	73.3	74.7	74.7	74.7	74.9	76.3
ATV58HD64N4•	45	60	93.5	84.3	84.8	88.8	89.7	92.3	89.7	92.3	93.8
ATV58HD79N4•	55	75	115.5	102.7	103.3	106.4	108.6	111.6	108.6	112.1	112.7

Ratings for Input Line Currents, Type H Variable Torque Low Noise 400/460 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58HU18N4 to D46N4 at 8 kHz, ATV58HD54N4 to D79N4 at 4 kHz

Drive Controller Catalog Number	Motor Power		Rated Output Current In A	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance 22000 AIC	
	400 V kW	460 V HP		400 V A	460 V A	400 V A	460 V A	400 V A	460 V A	400 V A	460 V A
ATV58HU18N4•	0.75	1	2.1	3.2	2.8	—	—	—	—	1.9	1.6
ATV58HU29N4•	1.5	2	3.4	5.5	4.8	—	—	—	—	3.3	3
ATV58HU41N4•	2.2	3	4.8	7.4	6.5	—	—	—	—	4.8	4.2
ATV58HU54N4X•	◆	5	7.6	—	10	—	—	—	—	—	7.5
ATV58HU72N4X•	◆	7.5	11	—	14.3	—	—	—	—	—	9.9
ATV58HU90N4X•	◆	10	14	—	18.1	—	—	—	—	—	13.1
ATV58HD12N4X•	◆	15	21	—	25.8	—	—	—	—	—	19.6
ATV58HD16N4X•	◆	20	27	—	32.4	—	—	—	—	—	25.9
ATV58HD23N4X•	◆	25	34	—	38.9	—	—	—	—	—	31.1
ATV58HD28N4•	18.5	25	34	36.3	32.7	36.9	33.4	37.4	34.1	37.6	34
ATV58HD33N4•	22	30	40	43.3	39	44.2	40.1	45.1	40.4	44.7	40.4
ATV58HD46N4•	30	40	52	56.9	51	58.5	52.8	60.3	54.5	60.2	54.3
ATV58HD54N4•	37	50	65	70.2	61.5	71.9	64.9	73.6	67	73.4	67
ATV58HD64N4•	45	60	77	84	74.4	88.8	79.8	91.8	82.8	91.8	82.5
ATV58HD79N4•	55	75	96	102.8	91.7	106.9	96.4	112.6	100.5	112.3	100

◆ This product is for 460 Vac applications at 5000 AIC. A line reactor (3% minimum) must be used at higher AIC ratings. See the following table for 400 Vac rated controllers in this range.

Altivar® 58 TRX AC Drives

Wiring Recommendations

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected based on the rated controller output current.

Ratings for Input Line Currents, Type H Variable Torque 400/460 Vac Three-Phase Input with Three-Phase Output Switching Frequency: ATV58HU18 to D23 at 8 kHz, ATV58HU28N4 to D46N4 at 4 kHz, ATV58HD54N4 to C33N4X at 2 kHz

Drive Controller Catalog Number	Motor Power		Rated Output Current In A	Input Line Current							
				5000 AIC		10000 AIC		22000 AIC		w/ Additional 3% Line Impedance 22000 AIC	
	400 V kW	460 V HP		400 V A	460 V A	400 V A	460 V A	400 V A	460 V A	400 V A	460 V A
ATV58HU18N4*	0.75	1	2.1	3.2	2.8	—	—	—	—	1.9	1.6
ATV58HU29N4*	1.5	2	3.4	5.5	4.8	—	—	—	—	3.3	3
ATV58HU54N4*	3	4	6.2	10.2	7.8	—	—	—	—	6.3	5.6
ATV58HU72N4*	4	5	7.6	12.2	10.7	—	—	—	—	8.6	7.2
ATV58HU90N4*	5.5	7.5	11	16.3	14.3	—	—	—	—	11.8	10.1
ATV58HD12N4*	7.5	10	14	20.7	18.2	22.7	19.9	26.5	21	16	13.2
ATV58HD16N4*	11	15	21	28.8	25.3	31.4	27.6	35.4	28	23.6	19.5
ATV58HD23N4*	15	20	27	36.5	32	39.6	34.7	44.7	35.6	30.6	25.8
ATV58HD28N4*▲	18.5	25	34	36.3	32.7	36.9	33.4	37.4	34.1	37.6	34
ATV58HD28N4*	22	30	40	42.3	38.1	43	38.7	43.9	39.8	43.6	39.6
ATV58HD33N4*	30	40	52	55.5	49.3	56.3	51.1	57.1	51.6	56.8	51.4
ATV58HD46N4*	37	50	65	68.9	61.8	70.9	63.5	72.3	65.4	72	65.1
ATV58HD54N4*	45	60	77	82.7	72.3	84.1	75.2	85.5	77.7	85.5	77.5
ATV58HD64N4*	55	75	96	103.7	91	107	96.3	111.1	100.8	111.1	100
ATV58HD79N4*	75	100	124	133.6	117.4	138	122.6	142.9	129.3	142.4	128.8
ATV58HC10N4X	90	125	156	—	—	129	161	144	180	159	176
ATV58HC13N4X	110	150	180	—	—	147	184	165	206	182	202
ATV58HC15N4X	132	200	240	—	—	185	232	212	265	234	260
ATV58HC19N4X	160	250	302	—	—	—	—	260	325	288	320
ATV58HC23N4X	200	300	361	—	—	—	—	300	373	329	366
ATV58HC25N4X	220	350	414	—	—	—	—	337	422	372	413
ATV58HC28N4X	250	400	477	—	—	—	—	375	468	414	460
ATV58HC31N4X	280	450	515	—	—	—	—	415	519	458	508
ATV58HC33N4X	315	500	590	—	—	—	—	455	569	502	557

▲ The ATV58AHD28N4 is rated for 8 kHz operation at 25 HP.
Note: Shaded items in the table indicate 30,000 AIC.

Ratings for Input Line Currents, Types E and F 200 Vac -10% / 240 Vac +10% Single-Phase Input with Three-Phase Output

Drive Controller Catalog Number	Motor Power at 4 kHz Switching Frequency		Rated Output Current (In) A	Input Line Current					
				2000 AIC		5000 AIC		with Additional 3% Line Impedance	
	kW	HP		200 V A	240 V A	200 V A	240 V A	200 V A	240 V A
ATV58EU09M2ZU	0.37	0.5	2.3	5.6	4.7	—	—	4.2	3.8
ATV58EU18M2ZU	0.75	1	4.1	9.8	8.3	—	—	7.9	7
ATV58EU29M2ZU	1.5	2	7.8	—	—	18.5	15.6	14.1	12.3
ATV58EU41M2ZU	2.2	3	11	—	—	25.6	21.6	20.5	17.5

Altivar® 58 TRX AC Drives Wiring Recommendations

NOTE: The input conductor ampacity rating should not be less than the ampacity rating selected based on the rated controller output current.

Ratings for Input Line Currents, Types E and F 200 Vac -10% / 240 Vac +10% Three-Phase Input with Three-Phase Output

Drive Controller Catalog Number	Motor Power at 4 kHz Switching Frequency		Rated Output Current (In)	Input Line Current			
				5000 AIC		with Additional 3% Line Impedance	
	kW	HP	A	200 V A	240 V A	200 V A	240 V A
ATV58EU29M2ZU	1.5	2	7.8	9.7	8.3	6.6	5.9
ATV58EU41M2ZU	2.2	3	11	13.4	11.4	9.5	8.5

Ratings for Input Line Currents, Types E and F 400 Vac -15% / 460 Vac +20% Three-Phase Input with Three-Phase Output

Drive Controller Catalog Number	Motor Power at 4 kHz Switching Frequency		Rated Output Current (In)	Input Line Current			
				5000 AIC		with Additional 3% Line Impedance	
	400 V kW	460 V HP	A	400 V A	460 V A	400 V A	460 V A
ATV58EU18N4ZU	0.75	1	2.3	3.4	2.6	1.9	1.6
ATV58EU29N4ZU	1.5	2	4.1	6	4.5	3.3	3
ATV58EU41N4ZU	2.2	3	5.8	7.8	6	4.8	4.2
ATV58EU54N4ZU	3	—	7.8	10.2	7.8	6.3	5.6
ATV58EU72N4ZU	4	5	10.5	13	10.1	8.6	7.2
ATV58EU90N4ZU	5.5	7.5	13	17	13.2	11.8	10.1

Ratings for Input Line Currents, Type N 208 to 230 Vac Single-Phase Input with Three-Phase Output / Three-Phase Input with Three-Phase Output

208 to 230 Vac, Single-Phase Input with 3-Phase Output

Drive Controller Catalog Number	Dissipated Power at Rated Load (Total)	Short Circuit Rating	Input Line Current	
	W	A RMS sym.	A	A
ATV58NU09M2*	42	2,000	5.6	4.7
ATV58NU18M2*	64	2,000	9.8	8.3
ATV58NU29M2*	107	5,000	18.5	15.6
ATV58NU41M2*■	160	5,000	25.6	21.6

■ When these drive controllers are used with a single-phase input, a line reactor (3% minimum) must be used.

208 to 230 Vac, 3-Phase Input with 3-Phase Output

Drive Controller Catalog Number	Dissipated Power at Rated Load (Total)	Short Circuit Rating	Input Line Current	
	W	A RMS sym.	A	A
ATV58NU29M2*	107	5,000	9.7	8.3
ATV58NU41M2*	160	5,000	13.4	11.4
ATV58NU54M2*	190	5,000	17.2	15
ATV58NU72M2*	240	5,000	22.4	19.5

Altivar® 58 TRX AC Drives

Wiring Recommendations

Ratings for Input Line Currents, Type N 400 to 460 Vac Three-Phase Input with Three-Phase Output

Drive Controller Catalog Number	Dissipated Power at Rated Load (Total)	Short Circuit Rating A RMS sym.	Input Line Current	
	W		A	A
ATV58NU18N4*	57	5,000	3.4	2.6
ATV58NU29N4*	97	5,000	6	4.5
ATV58NU41N4*	120	5,000	7.8	6
ATV58NU54N4*	170	5,000	10.2	7.8
ATV58NU72N4*	210	5,000	13	10.1
ATV58NU90N4*	295	5,000	17	13.2
ATV58ND12N4*	360	22,000	26.5	21

Output Wiring Precautions

The drive controller is sensitive to the amount of capacitance (either phase-to-phase or phase-to-ground) present on the output power conductors. If excessive capacitance is present, the drive controller may trip on overcurrent.

Follow the guidelines below when selecting output cable:

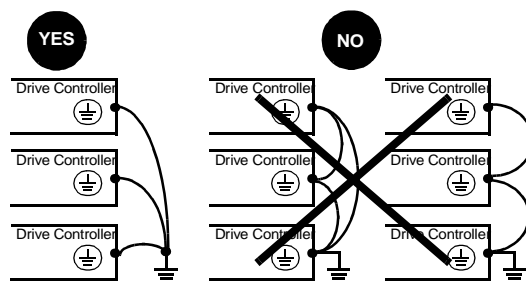
- Cable type: the cable selected must have a low capacitance phase-to-phase and to ground. Do not use mineral-impregnated cable because it has a very high capacitance. Immersion of cables in water increases capacitance.
- Cable length: the longer the cable, the greater the capacitance. Cable lengths greater than 100 ft (30.5 m) may affect controller and/or motor performance. For installations where cable length capacitances may be a problem, installing a reactor between the drive controller and the motor will increase inductance and decrease capacitance between cable conductors.
- Proximity to other output cables: because of high frequency switching and increased capacitance, the drive controller may fault under some conditions.
- **Do not use lightning arrestors and/or power factor correction capacitors on the output of the drive controller.**

NOTE: Provide at least 20 in. (500 mm) of cable at the drive controller output (U, V, W).

Grounding

For safe, dependable operation, ground the drive controller according to National Electrical Code and all local codes. To ground the drive controller:

- Connect a copper wire from the ground terminal on the drive controller (see the terminal locations on page 18) to the power system ground conductor. Wire size is determined by the drive controller size and by national and local codes.
- Verify that resistance to ground is one ohm or less. Improper grounding causes intermittent and unreliable operation.



Ground multiple drive controllers as shown in the figure to the left. Use one grounding conductor per device. Do not loop ground conductors or install them in series

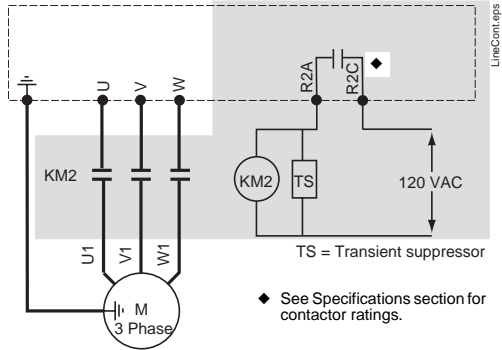
Altivar® 58 TRX AC Drives Wiring Recommendations

Using a Line Contactor or an Output Contactor

When controlling the power with a line isolation contactor, avoid frequently opening and closing the line contactor as this could cause premature failure of the drive controller. Use inputs LI1 to LI4 to start and stop the drive controller. Limit operations of the line contactor to less than once per minute.

To use an output contactor, use the wiring diagram to the left for guidance and set relay R2 to the Output Contactor Command function. In the wiring diagram at left, the shaded portion is to be added to the output of either the single-phase wiring diagram or the three-phase wiring diagram on page 108.

The recommended output contactors are shown in the table below.



Wiring Diagram for Output Contactor

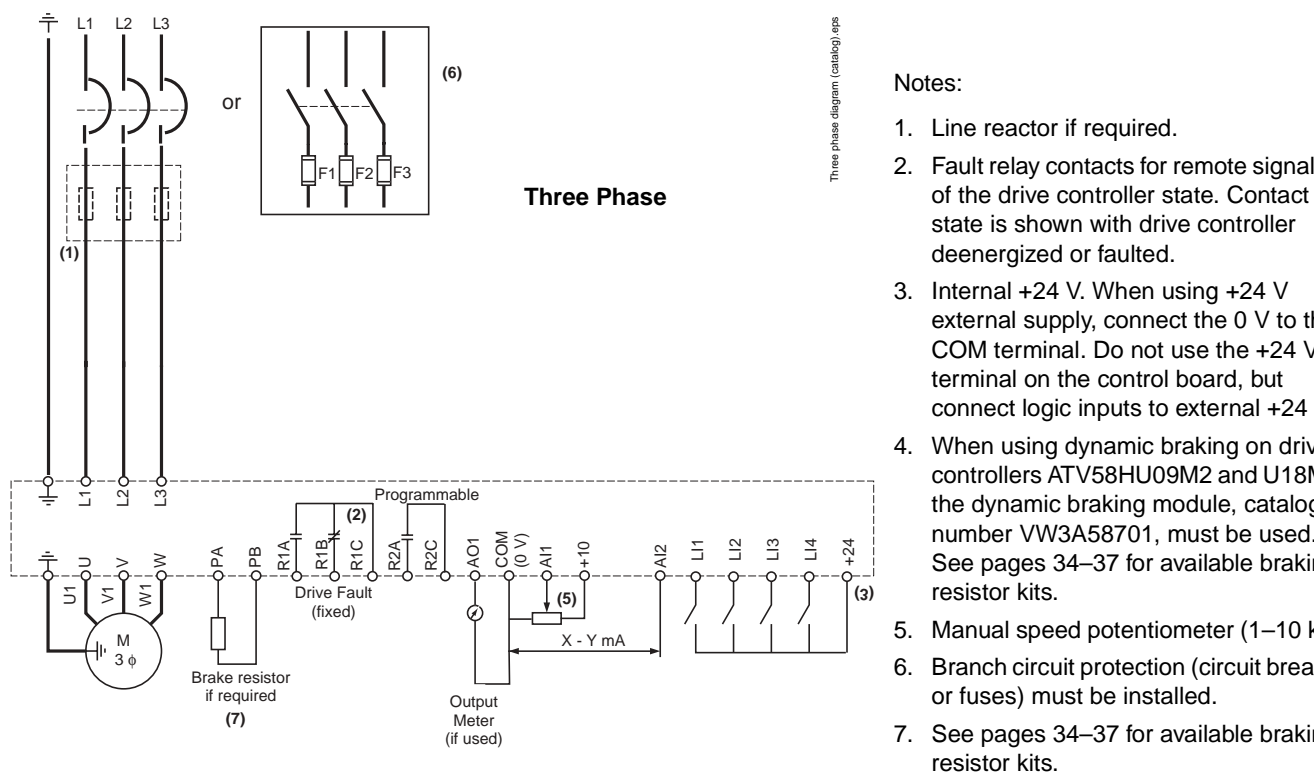
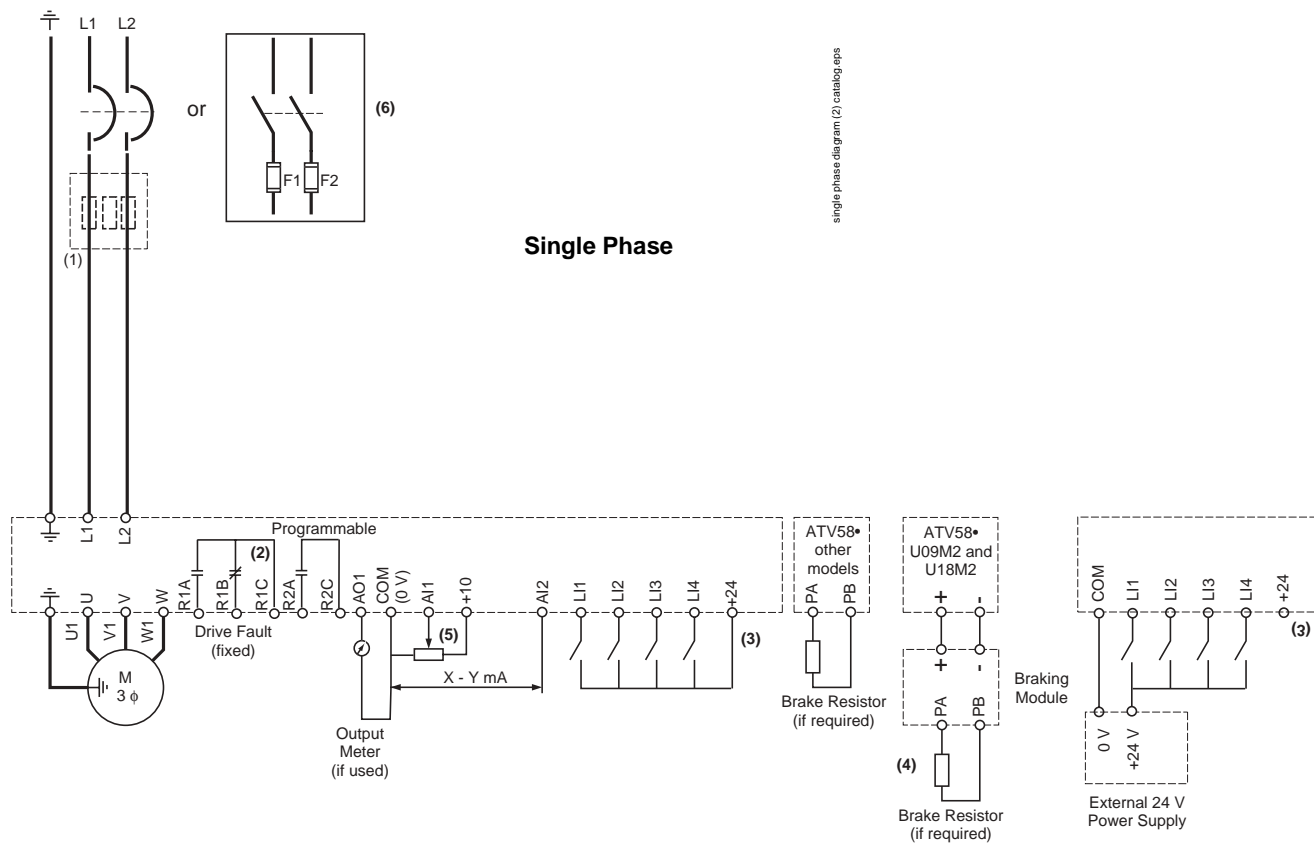
ATV58H*****	KM2 LC1-	ATV58H*****	KM2 LC1-
U09M2	D25♦	U18N4	D25♦
U18M2	D25♦	U29N4	D25♦
U29M2	D25♦	U41N4	D25♦
U41M2	D25♦	U72N4	D25♦
U72M2	D25♦	U90N4	D25♦
U90M2	D25♦	D12N4	D25♦
D12M2	D32♦	D16N4	D25♦
		D23N4	D4011♦
D16M2	D40♦	D28N4	D40♦
D23M2	D80♦	D33N4	D50♦
D28M2	D80♦	D46N4	D80♦
D33M2	D80♦	D54N4	D8010♦
D46M2	F115♦	D64N4	F115♦
		D79N4	F115♦

♦ Refer to the Digest for control voltage information.

Altivar® 58 TRX AC Drives

Wiring Recommendations

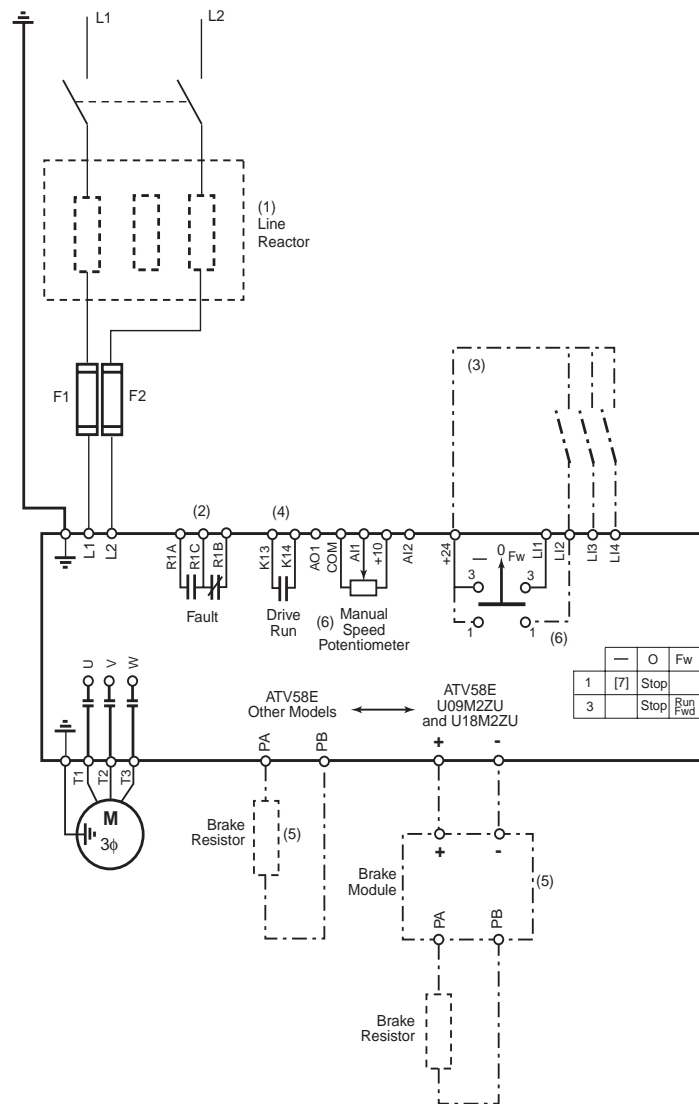
Wiring Diagrams for ATV58 TRX Type H and Type N Controllers



Notes:

1. Line reactor if required.
2. Fault relay contacts for remote signaling of the drive controller state. Contact state is shown with drive controller deenergized or faulted.
3. Internal +24 V. When using +24 V external supply, connect the 0 V to the COM terminal. Do not use the +24 V terminal on the control board, but connect logic inputs to external +24 V.
4. When using dynamic braking on drive controllers ATV58HU09M2 and U18M2, the dynamic braking module, catalog number VW3A58701, must be used. See pages 34–37 for available braking resistor kits.
5. Manual speed potentiometer (1–10 kΩ)
6. Branch circuit protection (circuit breaker or fuses) must be installed.
7. See pages 34–37 for available braking resistor kits.

Wiring Diagram for ATV58 TRX Type E Controllers (Single Phase)

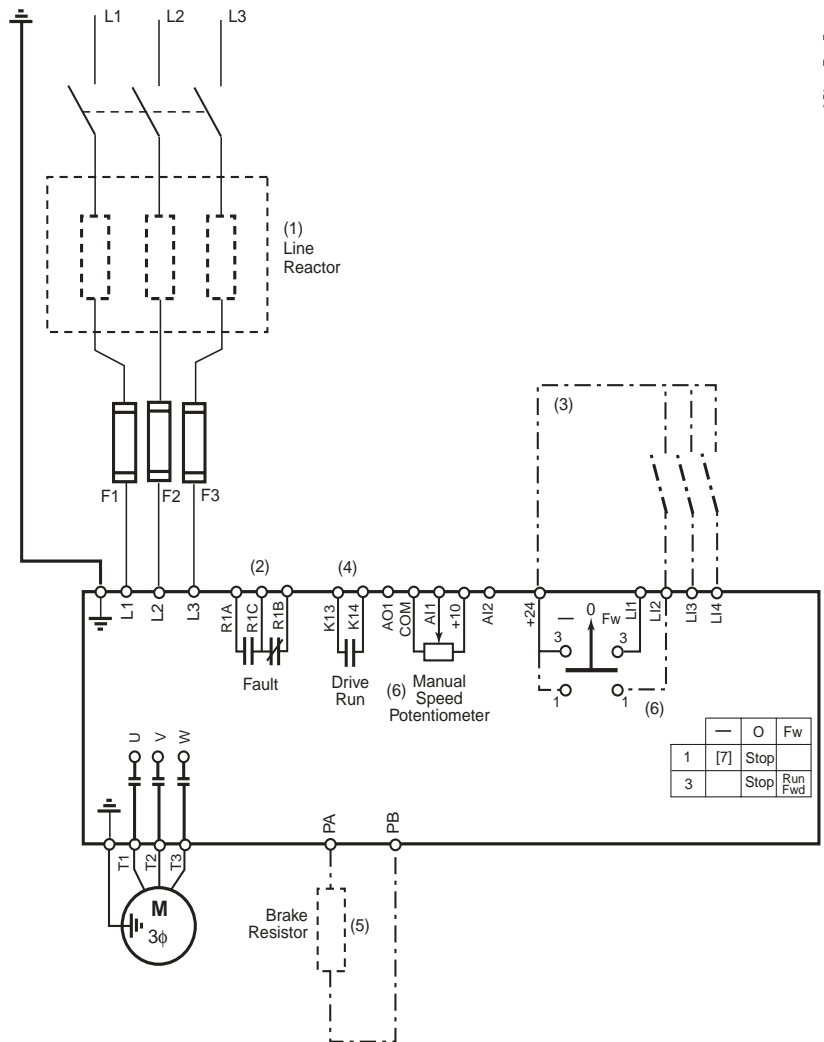


Notes

1. Line reactor, if required.
2. Fault relay contacts for remote signalling of the drive controller state. Contact state is shown with the drive controller de-energized or faulted.
3. Internal +24 V. When using a +24 Vdc external supply, connect the 0 V to the COM terminal. Do not use the +24 V terminal on the control board, but connect logic inputs to external +24 V.
4. Auxiliary on output contactor. If the controller is re-programmed, the R2 function must be assigned to Output Contactor Command.
5. Use dynamic braking module VW3A58701 with drive controllers ATV58EU09M2ZU and U18M2ZU if dynamic braking is required. See pages 34–37 for the available braking resistor kits.
6. Manual speed potentiometer and three-position switch are factory-installed in the terminal block cover. There is enough space in the terminal block cover to install two more 16-mm operators.
7. When user-installed wiring is added from terminals +24 to LI2 and when the drive controller programming is at the factory settings, placing the selector switch in this position will command the controller to run in reverse. The function of LI2 can be altered with the programming options. See page 50 for the functions to which LI2 may be assigned.

Altivar® 58 TRX AC Drives Wiring Recommendations

Wiring Diagram for ATV58 TRX Type E Controllers (Three Phase)

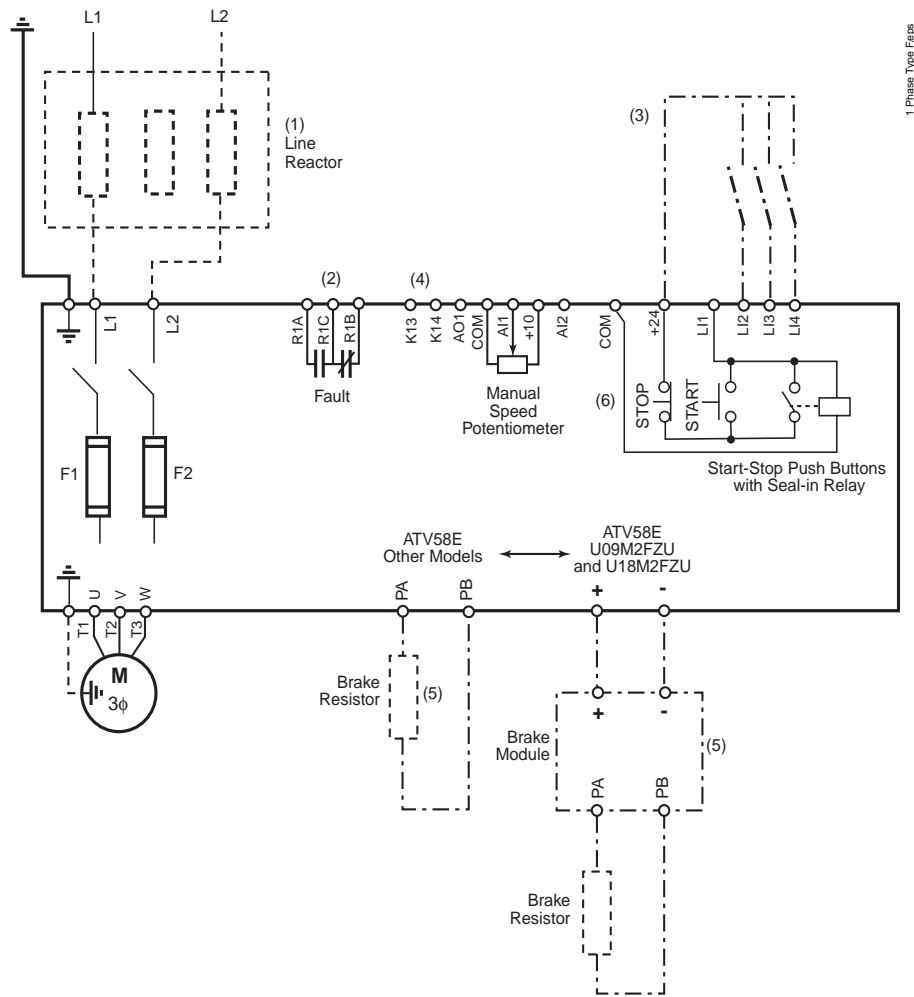


3 Phase Type E eps

Notes

1. Line reactor, if required.
2. Fault relay contacts for remote signalling of the drive controller state. Contact state is shown with the drive controller de-energized or faulted.
3. Internal +24 V. When using a +24 Vdc external supply, connect the 0 V to the COM terminal. Do not use the +24 V terminal on the control board, but connect logic inputs to external +24 V.
4. Auxiliary on output contactor. If the controller is re-programmed, the R2 function must be assigned to Output Contactor Command.
5. See pages 34–37 for the available braking resistor kits.
6. Manual speed potentiometer and three-position switch are factory-installed in the terminal block cover. There is enough space in the terminal block cover to install two more 16-mm operators.
7. When user-installed wiring is added from terminals +24 to LI2 and when the drive controller programming is at the factory settings, placing the selector switch in this position will command the controller to run in reverse. The function of LI2 can be changed using one of the available programming tools. See page 26 for a list of programming tools.

Wiring Diagram for ATV58 TRX Type F Controllers (Single Phase)



Notes

1. Line inductor, if required.
2. Fault relay contacts for remote signalling of the drive controller state. Contact state is shown with the controller de-energized or faulted.
3. User-installed wiring for using LI2, LI3, and LI4 with internal +24 V power supply. When using a +24 V external supply, connect the 0 V to the COM terminal. Do not use the +24 terminal on the control board but connect logic inputs to external +24 V.
4. K13 and K14 are open terminals available for customer use.
5. Use dynamic braking module VW3A58701 with drive controllers ATV58EU09M2FZU and U18M2FZU if dynamic braking is required. See page 34 for available braking resistor kits.
6. Manual speed potentiometer and start-stop push buttons are factory-installed in the enclosure cover. There is enough space in the cover to install one more 16-mm operator.

Recommended Branch Circuit Protection Devices

Branch circuit protection must be installed on the input (line side) of the drive controllers. Input fuses may be used on 1/2 hp to 500 hp drive controllers; circuit breakers may be used on 1/2 hp to 100 hp drive controllers.

Fuses

The fuses specified in Tables 1–3 (pages 113–114) are suitable for branch short circuit protection and provide excellent short circuit protection for the drive. Fuses are recommended for ATV58 TRX Type H and Type FVC drives when they are wall mounted.

Circuit Breakers

Circuit breakers will also provide branch short circuit protection. Because circuit breakers are typically slower than fuses, they are not as effective in limiting damage to the controller in the event of an internal drive short circuit such as shorted bus connections, shorted input rectifier, or failure of the internal solid state overcurrent protection circuit in the controller. Refer to the ALTIVAR 58 TRX Installation Guide for Type H Controllers (VVDED397048US) for recommended circuit breakers and application considerations.

Table 1: Recommended Fuses: 208/230 V Single-Phase Drive Controllers

Motor		Drive Controller	F1-F2 Line Power Fuses
hp	kW	ATV58H*****	Class J
0.5	0.37	U09M2	10 ^[1]
1	0.75	U18M2	15 ^[1]
2	1.5	U29M2	30 ^[1]
3	2.2	U41M2	30 ^[1]
4	3	U72M2	35 ^[1]
5	4	U90M2	60 ^[1]
7.5	5.5	D12M2	70 ^[1]
10	7.5	D16M2	90 ^[2]
15	11	D23M2	125 ^[2]
20	15	D28M2	150 ^[2]
25	18.5	D33M2	175 ^[2]
30	22	D46M2	200 ^[2]

[1] Fast-acting or time delay Class J fuses are acceptable. Class T fuses are acceptable. Class CC fuses may be used if recommended fuse rating is 30 A or lower.

[2] Fast-acting Class J fuses. Class T fuses are acceptable.

Table 2: Recommended Fuses: 208/230 V Three-Phase Drive Controllers

Motor		Drive Controller	F1-F2-F3 Line Power Fuses
hp	kW	ATV58H*****	Class J ^[1]
2	1.5	U29M2	15
3	2.2	U41M2	20
—	3	U54M2	30
5	4	U72M2	35
7.5	5.5	U90M2	60
10	7.5	D12M2	70

[1] Fast-acting or time delay Class J fuses are acceptable. Class T fuses are acceptable. Class CC fuses may be used if recommended fuse rating is 30 A or lower.

[2] Fast-acting Class J fuses. Class T fuses are acceptable.

hp	kW	CTLN ATV58H*****	F1-F2-F3 Class J ^[2]	CT, VTLN ATV58H** ***	F1-F2- F3 Class J ^[2]	VT ATV58H** ***	F1-F2-F3 Class J ^[2]
10	7.5	D16M2	70				
15	11	D23M2	90	D16M2	70	D16M2	70
20	15	D28M2	110	D23M2	90	D16M2	90
25	18.5	D33M2	125	D28M2	110	D23M2	125
30	22	D46M2	175	D33M2	125	D28M2	150
40	30			D46M2	175	D33M2	175
50	37					D46M2	200

CT	Constant Torque
CTLN	Constant Torque Low Noise
VTLN	Variable Torque Low Noise
VT	Variable Torque

Altivar® 58 TRX AC Drives

Wiring Recommendations

[1] Fast-acting or time delay Class J fuses are acceptable. Class T fuses are acceptable. Class CC fuses may be used if recommended fuse rating is 30 A or lower.

[2] Fast-acting Class J fuses. Class T fuses are acceptable.

[3] Use the Bussmann part numbers provided or equivalent.

Table 3: Recommended Fuses: 400/460 V Three-Phase Drive Controllers

Motor		Drive Controller CT, VTLN ATV58H*****	F1-F2-F3	Drive Controller VTLN ATV58H*****	F1-F2-F3
hp	kW		Line Power Fuses Class J [1]		Line Power Fuses Class J [1]
1	0.75	U18N4	5	—	—
2	1.5	U29N4	10	—	—
3	2.2	U41N4	12	—	—
—	3	U54N4	15	—	—
5	4	U72N4	20	U54N4X	20
7.5	5.5	U90N4	25	U72N4X	25
10	7.5	D12N4	40	U90N4X	40
15	11	D16N4	50	D12N4X	50
20	15	D23N4	70	D16N4X	70
25	18.5			D23N4X	70

CT	Constant Torque
CTLN	Constant Torque Low Noise
VTLN	Variable Torque Low Noise
VT	Variable Torque

hp	kW	CTLN ATV58H*****	F1-F2-F3 Class J [2]	CT, VTLN ATV58H*****	F1-F2-F3 Class J [2]	VT ATV58H*****	F1-F2-F3 Class J [2]
20	11	D28N4	70				
25	18.5	D33N4	80	D28N4	70	D28N4	70
30	22	D46N4	100	D33N4	80	D28N4	90
40	30	D54N4	125	D46N4	100	D33N4	110
50	37	D64N4	150	D54N4	125	D46N4	150
60	45	D79N4	200	D64N4	150	D54N4	175
75	55			D79N4	175	D64N4	200
100	75					D79N4	200

hp	kW	VT ATV58H*****	F1-F2-F3 [3]
125	90	C10N4X	FWH-300A
150	110	C13N4X	FWH-400A
200	132	C15N4X	FWH-500A
250	160	C19N4X	FWH-600A
300	200	C23N4X	FWH-700A
350	220	C25N4X	FWH-800A
400	250	C28N4X	FWH-900A
450	280	C31N4X	FWH-900A
500	315	C33N4X	FWH-1000A

Altivar® 58 TRX AC Drives Type H Specifications

ATV58 TRX TYPE H SPECIFICATIONS

Environmental Specifications

NOTE: Discoloration of drive controller plastic pieces will occur if exposed to direct sunlight.

Enclosure type	ATV58HU09M2 to U90N4: IP20/open type controllers according to Standard EN50178. ATV58HU90M2 to D46M2, ATV58HD12N4 to D79N4: UL Type 1 with conduit connection kit (see page 131 for list of conduit entry kits). ATV58HC10N4X to C33N4X: IP20 on all surfaces except the bottom. IP00 on the bottom due to the power connections.
Resistance to vibrations	According to IEC 60068-2-6: 1.5 mm zero to peak from 3 to 13 Hz 1 gn from 13 to 200 Hz ATV58HC10N4X-C33N4X: 0.6 gn from 10 to 55 Hz
Resistance to shocks	According to IEC 60068-2-27: 15 g, 11 ms
Ambient pollution degree	ATV58HU09M2-D12M2 and ATV58HU18N4-D23N4: Pollution degree 2 conforming to IEC 60664-1, EN50718, and NEMA ICS-1. ATV58HD16M2-D46M2 and ATV58HD28N4-D79N4: Pollution degree 3 conforming to IEC 60664-1, EN50718, and NEMA ICS-1. ATV58HC10N4X-C33N4X: Pollution degree 2 conforming to IEC 60664-1, EN 50718, and NEMA ICS-1. Protect the drive controller against dust, corrosive gas, and falling liquid.
Maximum relative humidity	95% maximum, non-condensing and without dripping according to IEC 60068-2-3. Provide a heating system if there is condensation.
Maximum ambient temperature	Storage: -25 to +65 °C (-13 to +149 °F) Operation: Drive controllers ATV58HU09M2-U72M2 and ATV58HU18N4-U90N4: ^[1] -10 to +50 °C (+14 to 122 °F) without derating -10 to +60 °C (+14 to 140 °F) with fan kit ^[2] and derating of the current 2.2% per °C above 50 °C Drive controllers ATV58HU90M2-D46M2 and ATV58HD12N4-D79N4: -10 to +40 °C (+14 to 104 °F) without derating -10 to +50 °C (+14 to 122 °F) with fan kit ^[2] and derating of the current 2.2% per °C above 40 °C Drive controllers ATV58HC10N4X-C33N4X: -10 to +40 °C (+14 to 104 °F) without derating -10 to +50 °C (+14 to 122 °F) with derating of the current 2.2% per °C above 40 °C
Altitude	3300 ft (1000 m) maximum without derating; derate the output current by 1% for each additional 330 ft (100 m)
Operating position	Vertical, ±10°, with power terminals at the bottom
<p>[1] ATV58HU54N4X, ATV58HU72N4X, and ATV58HU90N4X can be used at their highest VT rating in a 40 °C maximum ambient temperature.</p> <p>[2] See page 130 for list of fan kits.</p>	

Altivar® 58 TRX AC Drives

Type H Specifications

[1] The maximum allowable input line unbalance is 5% for 460 V input line short circuit capacity of 15,000 A, 2.5% for 460 V input line short circuit capacity of 30,000 A, 0.5% for 460 V input line short circuit capacity of 65,000 A. If the resulting voltage harmonic distortion exceeds 5%, three phase line reactors are recommended.

[2] Input voltage is 460 V, -10%, +15% on ATV58HU54N4X–D23N4X controllers as rated in the table on page 9. Input voltage is 400 V -15% to 460 V +10% on ATV58C10N4X–C33N4X.

[3] See page 26 and following for available accessories and options.

[4] The drive controller can be configured to reduce switching frequency if the drive thermal state reaches 95%. When the drive thermal state returns to 70%, the switching frequency returns to the set value. If the duty cycle (drive controller run time) does not exceed 60% (36 second maximum for a 60 second cycle) derating is not required.

[5] Motor thermal protection can be set between 25 and 136% of the drive controller rating.

Electrical Specifications

Input voltage ^[1]	208 V -15% to 230 V +15% single-phase input 208 V -15% to 230 V +15% three-phase input 400 V -15% to 460 V + 20% three-phase input ^[2]
Input frequency	50/60 Hz ±5%
Output voltage	Three-phase output, maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, supplies)
Output frequency	0.1 to 60 Hz (configurable to 500 Hz with programming options) ^[3]
Switching frequency	4 kHz, configurable with programming accessories ^[3] ATV58HU09M2–D12M2 and ATV58HU18N4–D23N4: 0.5 - 1 - 2 - 4 - 8 kHz without derating 12 - 16 kHz with derating of one hp rating in steady state 12 - 16 kHz without derating and with reduced duty cycle ^[4] ATV58HD16M2–D23M2 and ATV58HD28N4–D46N4: 0.5 - 1 - 2 - 4 - 8 kHz without derating 8 - 12 kHz with derating of one hp rating in steady state 8 - 12 kHz without derating and with reduced duty cycle ^[4] ATV58HD28M2–D46M2 and ATV58HD54N4–D79N4: 0.5 - 1 - 2 - 4 kHz without derating 8 kHz with derating of one hp rating in steady state 4 - 8 kHz without derating and with reduced duty cycle ^[4] ATV58HC10N4X–C33N4X: 0.5 - 1 - 2 kHz without derating 4 kHz without derating and with reduced duty cycle ^[4] 4 kHz with derating of one hp rating in steady state
Speed range	1:100 open loop (for example 0.6 Hz to 60 Hz) 1:10 open loop for ATV58HC10N4X–C33N4X
Speed regulation	1% of rated motor speed without adjustments or feedback. ±0.1% of rated motor speed with optional analog I/O card and appropriate tachometer feedback. ^[3] ±0.02% of rated motor speed with optional digital I/O card and appropriate encoder feedback. ^[3] 3% for ATV58HC10N4X–C33N4X
Efficiency	97% at full load typical.
Displacement power factor	98% through speed range.
Motor control algorithm	Sensorless flux vector control with a pulse width modulated (PWM) output wave form.
DC injection braking	Automatically on stopping as soon as frequency drops below 0.1 Hz for 0.5 seconds.
Braking torque	30% of nominal motor torque without dynamic braking (typical value). Up to 150% with the dynamic braking option (for constant torque ratings).
Transient output current	160% of nominal NEC rated motor current for 60 seconds (for constant torque ratings). 110% of nominal motor current for 60 seconds (for variable torque ratings).
Transient motor torque	200% of nominal motor torque (typical value at ±10%) for 2 seconds (for constant torque ratings). 170% of nominal motor torque (typical value at ±10%) for 60 seconds (for constant torque ratings).
Drive controller protection	Protection against short circuits: • between output phases • between output phases and ground • on outputs of internal supplies Thermal protection against overheating and overcurrent. Undervoltage and overvoltage faults. Protection against single-phase input operation on the three-phase drive controllers.
Motor protection	Thermal protection integrated in the drive controller by continuous calculation of I ² t, taking motor speed into account. ^[5] Motor thermal state is retained during loss of power. Motor thermal protection can be modified with a programming option to correspond to the type of motor cooling. ^[3] Protection against motor phase loss. Protection by motor thermal sensors with analog option card. ^[3]
Electrical isolation	Electrical isolation between power and control (inputs, outputs, supplies).
Available internal supplies	Protected against short-circuits and overloads. 1 (+) 10 V ±1% supply for the reference potentiometer (1–10 kΩ), maximum current 10 mA. 1 (+) 24 V supply (min. 20 V, max. 30 V) for control inputs, maximum current 200 mA.
Analog inputs AI	1 analog voltage input AI1: range 0-10 V, impedance 30 kΩ. 1 analog current input AI2: range 0-20 mA, impedance 100 Ω. (reassignable to x-y mA by programming x and y, with a definition of 0.1 mA). Frequency resolution in analog reference: 0.1 Hz for 100 Hz (10 bits). Accuracy: ± 1%, linearity ±0.5% of the maximum output frequency. Sampling time: 2 ms maximum.

Altivar® 58 TRX AC Drives Type H Specifications

Electrical Specifications (Continued)

Analog output AO1	X–Y mA analog output, with X and Y programmable from 0–20 mA. Factory setting: 0–20 mA. Maximum load impedance: 500 Ω Resolution: 0.04 mA (9 bits) Linearity: +/- 0.2 mA Accuracy: +/- 0.2 mA The analog output is updated every 2 mS, maximum.
Logic inputs LI	4 assignable logic inputs with impedance 3.5 kW, compatible with PLC level 1, standard IEC 60065A-68. Maximum length of shielded cable: 100 m (328 ft). Power supply + 24 Vdc (minimum 11 Vdc, maximum 30 Vdc). State 0 if < 5 Vdc, state 1 if ≥ 11 Vdc. Sampling time: 2 ms maximum. Other inputs: see option cards.
Logic outputs LO	2 relay logic outputs for R1 (fault relay) and R2 (assignable). Form C, 1 N.O., 1 N.C. contact protected against overvoltages (relay R1). 1 N.O. contact protected against overvoltages (relay R2). Minimum switching capacity: 10 mA for 24 Vdc. Maximum switching capacity: on a resistive load (cos φ = 1): 5 A for 250 Vac or 30 Vdc; on an inductive load (cos φ = 0.4 and L/R = 7 ms): 1.5 A for 250 Vac or 30 Vdc. Other outputs: see option cards
Communication	RS 485 multidrop serial link with simplified Modbus protocol as part of the standard product. Transmission speed: 19200 bps, no parity Use: connecting a terminal (option), microprocessor card, a PC (option), or connecting one or more PLCs.
Codes and standards	UL Listed per UL 508C as incorporating electronic overload protection: UL File E164874 CCN NMMS ATV58HU09M2 to D46M2 ATV58HU18N4 to D79N4 ATV58HC10N4X to C33N4X CSA Certified to CSA C22.2 No. 14. CSA File LR96921 Class 3211 06 ATV58HU09M2 to D46M2 ATV58HU18N4 to D79N4 CE Marked Conforms to applicable NEMA ICS, NFPA, IEC, and ISO 9001 standards.

Altivar® 58 TRX AC Drives

Type FVC Specifications

ATV58 TYPE FVC SPECIFICATIONS

Environmental Specifications

Enclosure type	ATV58HU18N4 to U90N4: IP21/open type controllers according to Standard EN50178. ATV58HD12N4 to D79N4: Type 1 with conduit entry kit.♦
Resistance to vibrations	According to IEC 60068-2-6: 1.5 mm zero to peak from 3 to 13 Hz, 1 gn from 13 to 200 Hz
Resistance to shocks	According to IEC 60068-2-27: 15 g, 11 ms
Ambient pollution degree	ATV58HU18N4–D23N4: Pollution degree 2 conforming to IEC 600664-1, EN50718 and NEMA ICS-1, Annex A. ATV58HD28N4–D79N4: Pollution degree 3 according to IEC 600664-1, EN50718 and NEMA ICS-1, Annex A. Protect the drive controller against dust, corrosive gas, and falling liquid.
Max. relative humidity	95% maximum, non-condensing and without dripping according to IEC 60068-2-3. Provide heating system if there is condensation.
Maximum ambient temperature	Storage: -25 to +65 °C (-13 to +149 °F) Operation: Drive controllers ATV58HU18N4 to U90N4: -10 to +50 °C (+14 to 122 °F) without derating -10 to +60 °C (+14 to 140 °F) with fan kit▲ and derating of the current 2.2% per °C above 50 °C Drive controllers ATV58HD12N4 to D79N4: -10 to +40 °C (+14 to 104 °F) without derating -10 to +50 °C (+14 to 122 °F) with fan kit▲ and derating of the current 2.2% per °C above 40 °C
Altitude	3300 ft (1000 m) maximum without derating; derate the output current by 1% for each additional 330 ft (100 m)
Operational position	Vertical, ±10°, with power terminals at the bottom.

♦ See page 33.

▲ See page 33.

NOTE: Discoloration of drive controller plastic pieces will occur if exposed to direct sunlight.

Electrical Specifications

Input voltage	400 V -15% to 460 V + 20% three phase input
Input frequency	50/60 Hz ±5%
Output voltage	Three-phase output, maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, supplies)
Output frequency	0 to 60 Hz (configurable to 450 Hz with programming options)♦
Switching frequency	4 kHz, configurable with programming options♦ ATV58HU18N4–D23N4: 0.5 - 1 - 2 - 4 - 8 kHz without derating 12 - 16 kHz with derating in steady state 12 - 16 kHz without derating and with reduced duty cycle ▲ ATV58HD28N4–D46N4: 0.5 - 1 - 2 - 4 kHz without derating 8 - 12 kHz with derating in steady state 8 - 12 kHz without derating and with reduced duty cycle▲ ATV58HD54N4–D79N4: 0.5 - 1 - 2 kHz without derating 4 - 8 kHz with derating in steady state 4 - 8 kHz without derating and with reduced duty cycle▲
Speed range	1:100 Open loop. 1:1000 Closed loop.
Speed regulation	1% of rated motor speed without adjustments or feedback. ±0.01% of rated motor speed with appropriate encoder feedback.
Efficiency	97% at full load typical.
Displacement power factor	98% through speed range.
Motor control algorithm	Sensorless flux vector control with a pulse width modulated (PWM) output wave form.
Braking torque	30% of nominal motor torque without dynamic braking (typical value). Up to 150% with dynamic braking option.
Transient output current	160% of nominal NEC rated motor current for 60 seconds (for constant torque ratings). 110% of nominal motor current for 60 seconds (for variable torque ratings).
Transient motor torque	200% of nominal motor torque (typical value at ±10%) for 2 seconds. 170% of nominal motor torque (typical value at ±10%) for 60 seconds.

♦ Accessories are described starting on page 26.

▲ The drive controller can be configured to reduce switching frequency if the drive thermal state reaches 95%. When the drive thermal state returns to 70%, the switching frequency returns to the set value. If the duty cycle (drive controller run time) does not exceed 60% (36 second maximum for a 60 second cycle) derating is not required.

Electrical Specifications (Continued)

Drive controller protection	<p>Protection against short circuits:</p> <ul style="list-style-type: none"> • between output phases • between output phases and ground • on outputs of internal supplies <p>Thermal protection against overheating and overcurrent.</p> <p>Undervoltage and overvoltage faults.</p> <p>Protection against single-phase input operation on the three-phase drive controllers.</p>
Motor protection	<p>Thermal protection integrated in the drive controller by continuous calculation of I^2t, taking motor speed into account.■</p> <p>Motor thermal state is retained during loss of power.</p> <p>Motor thermal protection can be modified with a programming option to correspond to the type of motor cooling.♦</p> <p>Protection against motor phase loss.</p> <p>Protection by motor thermal sensors with analog option card.♦</p>
Electrical isolation	Electrical isolation between power and control (inputs, outputs, supplies).
Available internal supplies	<p>Protected against short-circuits and overloads.</p> <p>One (+)10 V ± 1% supply for the reference potentiometer (1-10 kΩ), maximum current 10 mA.</p> <p>One (+)24 V supply (min 20 V, max 30 V) for control inputs, maximum current 200 mA.</p>
Bandwidth	25 to 50 Hz
Analog speed reference input	<p>-10 V/+10 V, 11 bits + sign, accuracy ± 0.5% of max value, linearity ± 0.2% of max value.</p> <p>0-20mA 10 bit (scalable x-y), resolution 0.02 mA accuracy ± 1% of max value, linearity ± 0.5% of max value.</p>
Digital Frequency Resolution	With a communication card, range is 0 to 32768 points for 500 Hz. (Resolution 0.015 Hz)
Analog output	0-20 mA 11 bit (0-20 scalable x-y), resolution 0.02 mA accuracy ± 1% of max value, linearity ± 0.5% of max value.
Encoder connection	Quadrature A+, A-, B+, B- with 5 Vdc supplied on board, selectable pulses per revolution 100-5000, 200 kHz maximum input.
Analog inputs AI	<p>1 analog voltage input AI1: range 0-10 V, impedance 30 kΩ.</p> <p>1 analog current input AI2: range 0-20 mA, impedance 100 Ω.</p> <p>(reassignable to x-y mA by programming x and y, with a definition of 0.1 mA).</p> <p>Sampling time: 2 ms maximum.</p>
Logic inputs LI	<p>4 assignable logic inputs with impedance 3.5 kΩ, compatible with PLC level 1, standard IEC 65A-68.</p> <p>Maximum length of shielded cable: 100 m (328 ft).</p> <p>Power supply + 24 Vdc (minimum 11 Vdc, maximum 30 Vdc).</p> <p>State 0 if < 5 Vdc, state 1 if ≥ 11 Vdc.</p> <p>Sampling time: 2 ms maximum.</p> <p>Other inputs: see option cards.</p>
Logic outputs	<p>2 relay logic outputs for R1 (fault relay) and R2 (assignable).</p> <p>Form C, 1 N.O., 1 N.C. contact protected against overvoltages (relay R1).</p> <p>1 N.O. contact protected against overvoltages (relay R2).</p> <p>Minimum switching capacity: 10 mA for 24 Vdc.</p> <p>Maximum switching capacity: on a resistive load (cos φ = 1): 5 A for 250 Vac or 30 Vdc on an inductive load (cos φ = 0.4 and L/R = 7 ms): 1.5 A for 250 Vac or 30 Vdc</p> <p>Other outputs: see option cards</p>
Communication	<p>RS 485 multidrop serial link with simplified Modbus protocol as part of the standard product.</p> <p>Transmission speed: 19200 bps, no parity</p> <p>Use: connecting a terminal (option), microprocessor card, a PC (option), or connecting one or more PLCs.</p>
Codes and standards	<p>UL Listed per UL 508C as incorporating electronic overload protection: UL File E164874, CCN NMMS ATV58HU18N4 to D79N4</p> <p>CSA Certified to CSA C22.2 No. 14. CSA File LR96921, Class 3211 06 ATV58HU18N4 to D79N4</p> <p>CE Marked</p> <p>Conforms to applicable NEMA ICS, NFPA, IEC, and ISO 9001 standards.</p>

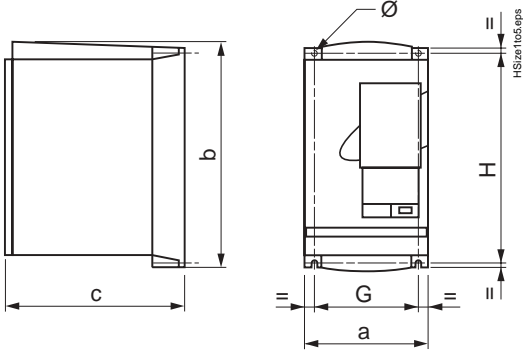
♦ Accessories are described starting on page 26.

■ Motor power rating must be between 25% minimum, 136% maximum, of drive controller rating.

Altivar® 58 TRX AC Drives Dimensions

DIMENSIONS

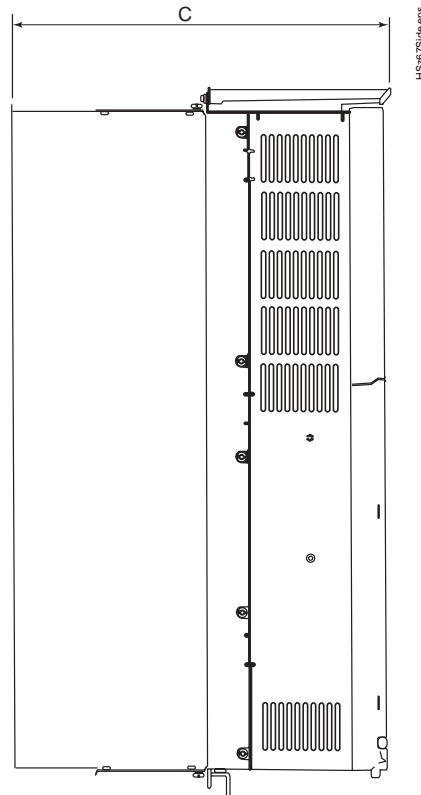
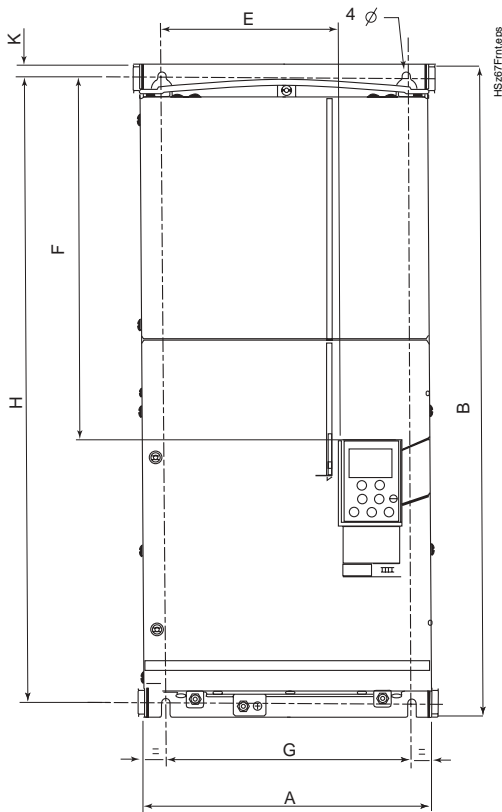
ATV58 TRX Type H and Type FVC Models



Dimensions for Type H and Type FVC
Frame Sizes 1 to 5

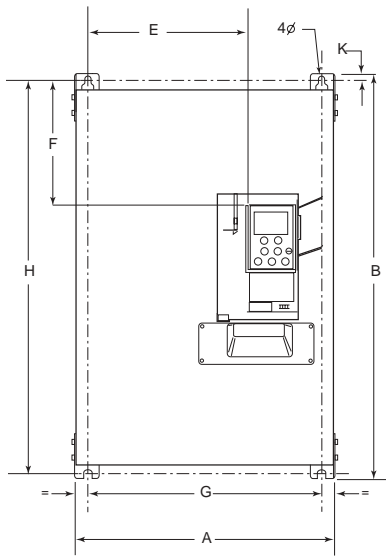
Frame Size	Catalog Number ATV58****	a in. (mm)	b in. (mm)	c in. (mm)	G in. (mm)	H in. (mm)	Ø in. (mm)
1	U09M2, U18M2	4.45 (113)	8.11 (206)	6.58 (167)	3.78 (96)	7.48 (190)	0.20 (5)
2	U29M2, U41M2, U18N4, U29N4, U41N4	5.91 (150)	9.06 (230)	7.24 (184)	5.20 (133)	8.27 (210)	0.20 (5)
3	U54M2, U72M2, U54N4, U72N4, U90N4	6.89 (175)	11.26 (286)	7.24 (184)	6.10 (155)	10.63 (270)	0.22 (5.5)
4	U90M2, D12M2, D12N4, D16N4	9.06 (230)	12.80 (325)	8.27 (210)	7.9 (200)	12.20 (310)	0.22 (5.5)
5	D23N4	9.06 (230)	16.35 (415)	8.27 (210)	7.9 (200)	15.75 (400)	0.22 (5.5)

Frame Size	Catalog Number ATV58****	A in. (mm)	B in. (mm)	C in. (mm)	E in. (mm)	F in. (mm)	G in. (mm)	H in. (mm)	K in. (mm)	Ø in. (mm)
6	D16M2, D23M2 D28N4, D33N4 D46N4	9.45 (240)	21.65 (550)	11.14 (283)	5.75 (146)	12.05 (306)	8.07 (205)	20.87 (530)	0.39 (10)	0.28 (7)
7	D28M2, D33M2 D46M2, D54N4 D64N4, D79N4	13.78 (350)	25.59 (650)	11.97 (304)	9.29 (236)	15.35 (390)	11.81 (300)	24.37 (619)	0.35 (10)	0.36 (9)

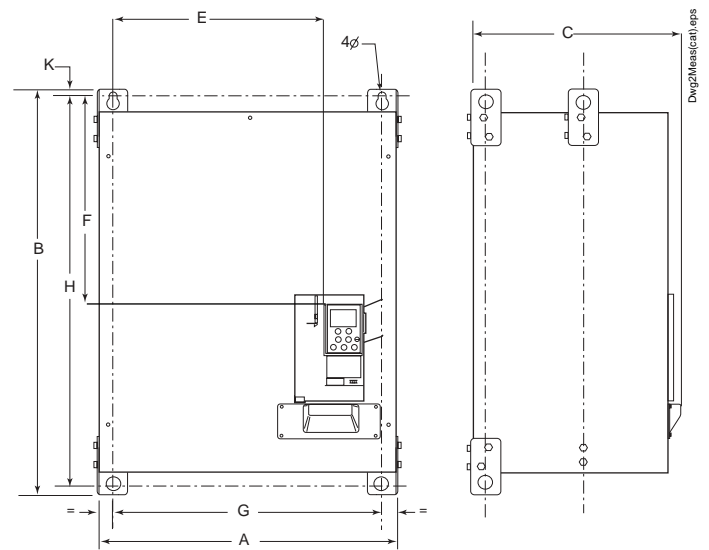


Dimensions for Type H and Type FVC
Frame Sizes 6 and 7

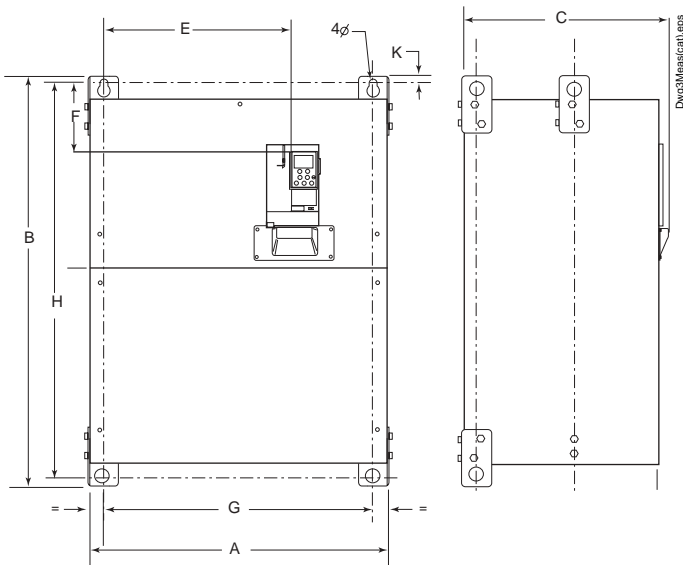
Altivar® 58 TRX AC Drives Dimensions



Frame Size 8 Dimensions



Frame Size 9 Dimensions



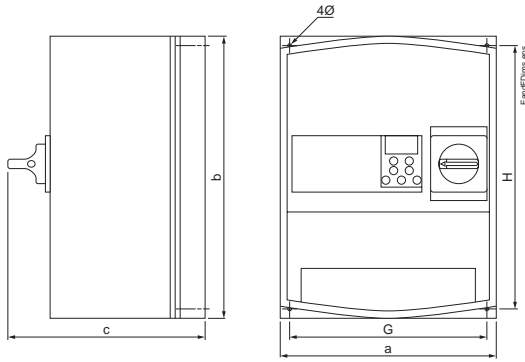
Frame Size 10 Dimensions

ATV58 TRX Type H (continued)

Product Frame Size	Catalog No. ATV58H****	A in. (mm)	B in. (mm)	C in. (mm)	E in. (mm)	F in. (mm)	G in. (mm)	H in. (mm)	K in. (mm)	Ø in. (mm)	Weight lb (kg)
8	C10N4X	14.6 (370)	25.2 (640)	14.2 (360)	9.25 (235)	8.25 (210)	12.63 (321)	24.5 (622)	0.50 (13)	0.50 (13)	108 (49)
9	C13N4X C15N4X C19N4X	18.9 (480)	27.2 (690)	15.7 (400)	13.38 (340)	14.25 (362)	16.75 (425)	26.00 (660)	0.50 (13)	0.50 (13)	169 (77)
10	C23N4X C25N4X C28N4X C31N4X C33N4X	26 (660)	37.6 (955)	17.3 (440)	15.88 (403)	7.00 (178)	23.50 (597)	36.38 (924)	0.50 (13)	0.50 (13)	370 (168)

Altivar® 58 TRX AC Drives

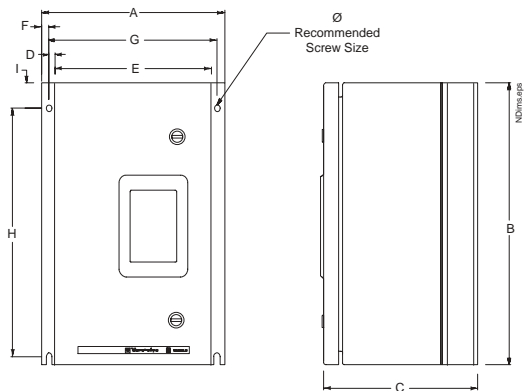
Dimensions



Dimensions for Type E and Type F Models

ATV58 TRX Type E and Type F Models

Frame Size	Catalog Number ATV58E/F****	a in. (mm)	b in. (mm)	c in. (mm)	G in. (mm)	H in. (mm)	Ø in. (mm)
1	U09M2ZU, U18M2ZU	9.06 (230)	12.44 (316)	8.46 (215)	8.27 (210)	11.81 (300)	0.22 (5.5)
2	U29M2ZU, U18N4ZU, U29N4ZU, U41N4ZU	10.63 (270)	13.27 (337)	9.84 (250)	9.84 (250)	12.64 (321)	0.22 (5.5)
3	U41M2ZU, U54N4ZU, U72N4ZU, U90N4ZU	11.81 (300)	15.98 (406)	11.06 (281)	11.02 (280)	15.39 (391)	0.22 (5.5)



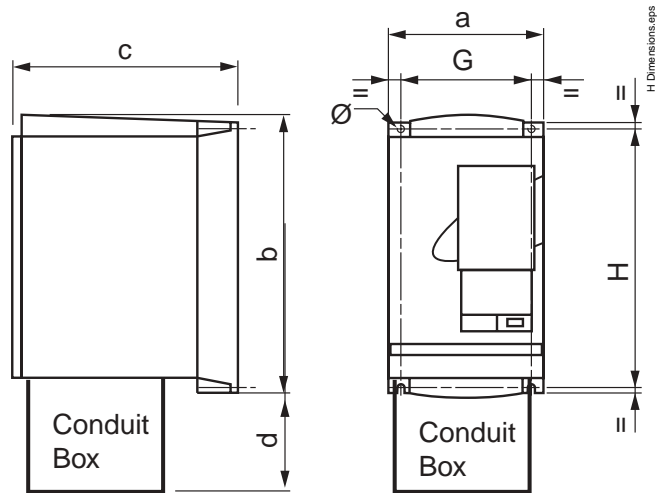
ATV58 TRX Type N Models

Catalog Number ATV58N****	A in. (mm)	B in. (mm)	C in. (mm)	D in. (mm)	E in. (mm)	F in. (mm)	G in. (mm)	H in. (mm)	I in. (mm)	J in. (mm)	Ø in. (mm)
U09M2, U18M2	9.42 (239)	12.50 (317)	7.88 (200)	0.29 (7)	8.05 (204)	0.40 (10)	8.63 (219)	11.00 (279)	1.12 (28)	15.30 (389)	1/4-20 (M6)
U29M2, U41M2, U18N4, U29N4, U41N4	10.88 (276)	14.00 (356)	10.06 (256)	0.31 (8)	9.00 (229)	0.62 (15.8)	9.63 (245)	12.50 (317)	1.12 (28)	18.43 (468)	1/4-20 (M6)
U72M2, U72N4, U90N4	11.75 (298)	16.00 (406)	11.00 (279)	0.38 (10)	10.00 (254)	0.50 (13)	10.75 (273)	14.25 (362)	1.25 (32)	20.37 (517)	3/8-16 (M10)
D12N4	15.25 (387)	20.00 (508)	14.75 (375)	0.50 (13)	13.25 (337)	0.50 (13)	14.25 (362)	18.25 (464)	1.25 (32)	27.37 (695)	3/8-16 (M10)

Catalog Number	Conduit Hole Size
ATV58NU09M2, ATV58NU18M2	7/8 inch
All other Type N models	1-3/32 inch

Dimensions for Type N Models

Conduit Entry Kit (VW3A58842 to VW3A58845)

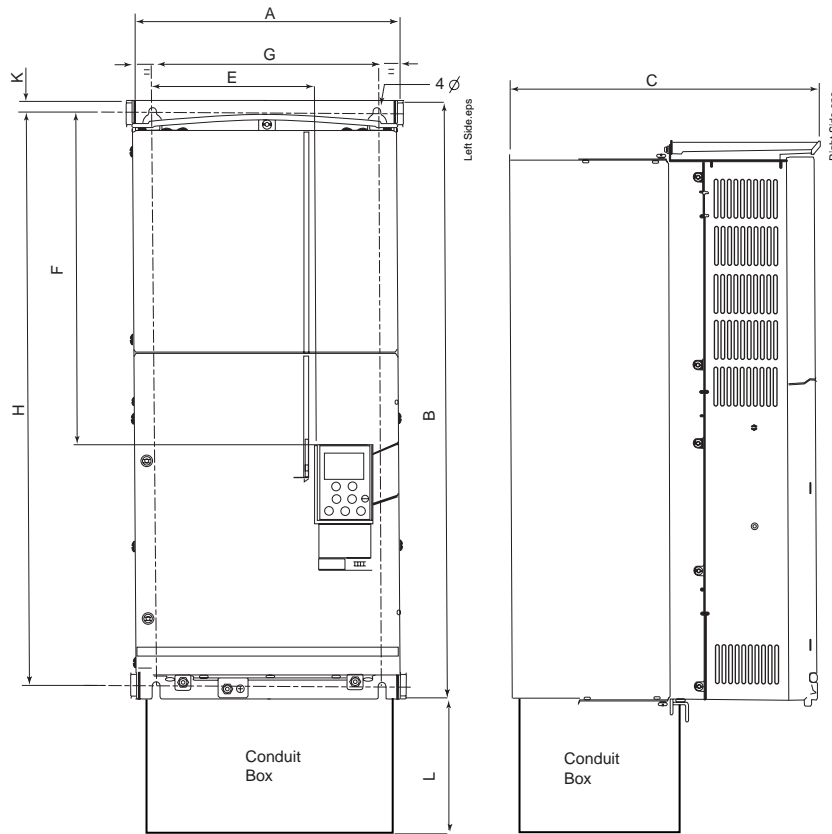


Conduit Entry Kit	Product Frame Size	Catalog No. ATV58H****	a in. (mm)	b in. (mm)	c in. (mm)	G in. (mm)	H in. (mm)	Ø in. (mm)	d in. (mm)	No. of Knock-outs & Conduit Sizes
VW3A58842	1	U09M2, U18M2	4.45 (113)	8.11 (206)	6.58 (167)	3.78 (96)	7.48 (190)	0.20 (5)	2.63 (66.7)	4 @ 1/2" and 3/4"
VW3A58843	2	U29M2, U41M2, U18N4, U29N4, U41N4	5.91 (150)	9.06 (230)	7.24 (184)	5.20 (133)	8.27 (210)	0.20 (5)	2.81 (71)	4 @ 1/2" and 3/4"
VW3A58844	3	U54M2, U72M2, U54N4, U72N4, U90N4	6.89 (175)	11.26 (286)	7.24 (184)	6.10 (155)	10.63 (270)	0.22 (5.5)	2.94 (75)	4 @ 1/2" and 3/4"
VW3A58845	4	U90M2, D12M2, D12N4, D16N4	9.06 (230)	12.80 (325)	8.27 (210)	7.9 (200)	12.20 (310)	0.22 (5.5)	2.94 (75)	4 @ 1/2", 3/4", and 1"
	5	D23N4	9.06 (230)	16.35 (415)	8.27 (210)	7.9 (200)	15.75 (400)	0.22 (5.5)	2.94 (75)	4 @ 1/2", 3/4", and 1"

Altivar® 58 TRX AC Drives

Dimensions

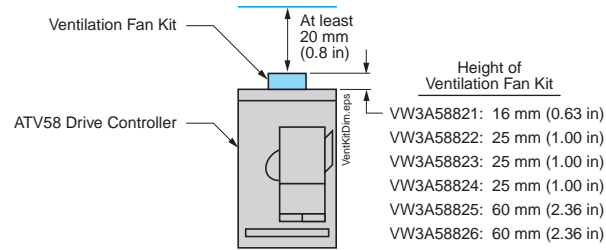
Conduit Entry Kit (VW3A58846 and VW3A58847)



Conduit Entry Kit	Product Frame Size	Catalog No. ATV58H*****	A in. (mm)	B in. (mm)	C in. (mm)	E in. (mm)	F in. (mm)	G in. (mm)	H in. (mm)	K in. (mm)	Ø in. (mm)	L in. (mm)	No. of Knock-outs & Conduit Sizes
VW3A58846	6	D16M2, D23M2 D28N4, D33N4 D46N4	9.45 (240)	21.65 (550)	11.14 (283)	5.75 (146)	12.05 (306)	8.07 (205)	20.87 (530)	0.39 (10)	0.28 (7)	3.5 (89)	2 @ 1/2", 3/4", & 1" 2 @ 1", 1-1/4", and 1-1/2"
VW3A58847	7	D28M2, D33M2 D46M2, D54N4 D64N4, D79N4	13.78 (350)	25.59 (650)	11.97 (304)	9.29 (236)	15.35 (390)	11.81 (300)	24.37 (619)	0.39 (10)	0.35 (9)	6.75 (171)	2 @ 1/2", 3/4", & 1" 2 @ 1", 1-1/4", 2", and 2-1/2"

Altivar® 58 TRX AC Drives Dimensions

Ventilation Fan Kits (VW3A58821 to VW3A58826)



Single-Phase Line Reactors (VW3A58501 and VW3A58502)

		A mm (in)	B mm (in)	φ mm (in)
	VW3A58501	95 (3.7)	65 (2.6)	5 x 11 (0.20 x 0.43)
	VW3A58502	105 (4.1)	77 (3.0)	6 x 12 (0.24 x 0.47)

RFI Input Filters (EMC) (VW3A58401 to VW3A58407)

		a mm (in)	b mm (in)	c mm (in)	G mm (in)	H mm (in)	φ mm (in)
	VW3A58401	113 (4.5)	246 (9.7)	36 (1.4)	94.5 (3.7)	230 (9.1)	5 (0.20)
	VW3A58402	150 (5.9)	276 (10.9)	50 (2.0)	133 (5.2)	260 (10.2)	5 (0.20)
	VW3A58403	175 (6.9)	340 (13.4)	60 (2.4)	153 (6.0)	320 (12.6)	6 (0.24)
	VW3A58404	230 (9.1)	390 (15.4)	60 (2.4)	200 (7.9)	370 (14.6)	6 (0.24)
	VW3A58405	230 (9.1)	480 (18.9)	60 (2.4)	200 (7.9)	460 (18.1)	6 (0.24)
	VW3A58406	240 (9.5)	690 (27.2)	85 (3.3)	205 (8.1)	650 (25.6)	7 (0.28)
	VW3A58407	240 (9.5)	690 (27.2)	85 (3.3)	205 (8.1)	650 (25.6)	7 (0.28)
	VW3A58408	350 (13.8)	770 (30.3)	90 (3.5)	300 (11.8)	770 (30.3)	9 (0.35)

Plate for EMC Mounting

	EMC Kit Number	Mount on:	b mm (in)	Diameter of Tapped Holes in Plate
	VW3A58831	ATV58U09M2, ATV58U18M2	63 (2.48)	M4
	VW3A58832	ATV58U29M2, ATV58U41M2, ATV58U18N4, ATV58U29N4, ATV58U41N4	64.5 (2.54)	M4
	VW3A58833	ATV58U54M2, ATV58U72M2, ATV58U54N4, ATV58U72N4, ATV58U90N4		
	VW3A58834	ATV58U90M2, ATV58D12M2, ATV58D12N4, ATV58D16N4, ATV58D23N4	62 (2.44)	M4

Altivar® 58 TRX AC Drives Weights

WEIGHTS

ATV58 TRX Type H Models (without EMI Filter)

Frame Size	Catalog Number ATV58H*****	Weight lb (kg)
1	U09M2, U18M2	4.9 (2.2)
2	U29M2, U41M2, U18N4, U29N4, U41N4	8.4 (3.8)
3	U54M2, U72M2, U54N4, U72N4, U90N4	15.2 (6.9)
4	U90M2, D12M2, D12N4, D16N4	26 (11.9)
5	D23N4	31 (13.9)
6	D16M2, D23M2, D28N4, D33N4, D46N4	71 (32.2)
7	D28M2, D33M2, D46M2, D54N4, D64N4, D79N4	120 (54.4)
8	C10N4X	120 (49)
9	C13N4X, C15N4X, C19N4X	169 (77)
10	C23N4X, C25N4X, C28N4X, C31N4X, C33N4X	370 (168)

ATV58 Type FVC Models (with EMI Filter)

Frame Size	Catalog Number ATV58FH*****	Weight lb (kg)
2	U18N4, U29N4, U41N4	8.4 (3.8)
3	U54N4, U72N4, U90N4	15.2 (6.9)
4	D12N4, D16N4	28.7 (13)
5	D23N4	33.2 (15)
6	D28N4, D33N4, D46N4	75 (34.0)
7	D54N4, D64N4, D79N4	126 (57.0)

ATV58 TRX Type E and Type F Models

Frame Size	Catalog Number ATV58E***** and ATV58F*****	Weight lb (kg)
1	U09M2ZU, U18M2ZU	9.5 (4.31)
2	U29M2ZU, U18N4ZU, U29N4ZU, U41N4ZU	10.5 (4.76)
3	U41M2ZU, U54N4ZU, U72N4ZU, U90N4ZU	19.5 (8.84)

ATV58 TRX Type N Models

Catalog Number ATV58N*****	Weight lb (kg)
U09M2, U18M2	18 (8.2)
U29M2, U41M2, U18N4, U29N4, U41N4	28 (12.7)
U72M2, U72N4, U90N4	42 (19.1)
D12N4	67 (30.5)

SELECTION

Catalog Number Identification

The product catalog numbers are derived according to the following rules:

Drive Controller	Type	Rating	Voltage	Internal EMC Filter	Keypad and US Manual
ATV58X ZZZ XX Y XY Type <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Rating <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Voltage <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Filter option <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Keypad/manual option <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	E: Equipped – Type 1 F: Fused – Type 12 H: Open style N: Type 4X FH: Open style, full flux vector control	U09: kVA	M2: 208/230 Vac N4: 400/460 Vac	X: No Filter. If an X is not in the part number in this position, the model has an internal EMC filter.	KU: With keypad* ZU: Without keypad

◆ Keypad only available factory installed on Type FVC and Type N drive.

The catalog numbers of the options and accessories are derived using the following rules:

Option Prefix	Type	Sub-type and Rating
VW3A58X YYY Type <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Subtype & Rating <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	1: Dialog option 3: Communication card 5: Line reactors 8: Other accessories 2: I/O option card 4: Filters 7: Braking options	01U

Available Type H Models



ATV58 TRX Fam10827Retouched.eps

Input Line Voltage	3-Phase Motor Power (HP)				Continuous Output Current (A)				Catalog No. without Keypad
	CT [■]	CTLN [■]	VT [■]	VTLN [■]	CT [■]	CTLN [■]	VT [■]	VTLN [■]	
208/230 Vac Single-Phase	0.5	—	—	0.5	2.3	—	—	2.5	ATV58HU09M2ZU
	1	—	—	1	4.1	—	—	4.8	ATV58HU18M2ZU
	2	—	—	2	7.8	—	—	7.8	ATV58HU29M2ZU
	3	—	—	3	11	—	—	11	ATV58HU41M2ZU
	4	—	—	4	13.7	—	—	14.3	ATV58HU72M2ZU
	5	—	—	5	18.2	—	—	17.5	ATV58HU90M2ZU
	7.5	—	—	7.5	24.2	—	—	25.3	ATV58HD12M2ZU
208/230 Vac 3-Phase	2	—	2	2	7.8	—	7.5	7.5	ATV58HU29M2ZU
	3	—	3	3	11	—	10.6	10.6	ATV58HU41M2ZU
	4	—	4	4	13.7	—	14.3	14.3	ATV58HU54M2ZU
	5	—	5	5	18.2	—	16.7	16.7	ATV58HU72M2ZU
	7.5	—	7.5	7.5	24.2	—	24.2	24.2	ATV58HU90M2ZU
	10	—	10	10	31	—	30.8	30.8	ATV58HD12M2ZU
	15	10	15/20	15	47	31	46.2/60	46.2	ATV58HD16M2XZU
	20	15	25	20	60	47	75	60	ATV58HD23M2XZU
	25	20	30	25	75	60	88	75	ATV58HD28M2XZU
	30	25	40	30	88	75	116	88	ATV58HD33M2XZU
	40	30	50	40	116	88	143	116	ATV58HD46M2XZU

■ Abbreviations: CT = constant torque CTLN = constant torque, low noise; VT = variable torque; VTLN = variable torque, low noise.

Altivar® 58 TRX AC Drives Selection

Available Type H Models (Continued)

Input Line Voltage	3-Phase Motor Power (HP)				Continuous Output Current (A)				Catalog No. without Keypad
	CT [■]	CTLN [■]	VT [■]	VTLN [■]	CT [■]	CTLN [■]	VT [■]	VTLN [■]	
400/460 Vac 3-Phase	1	—	1	1	2.3	—	2.1	2.1	ATV58HU18N4ZU
	2	—	2	2	4.1	—	3.4	3.4	ATV58HU29N4ZU
	3	—	3	3	5.8	—	4.8	4.8	ATV58HU41N4ZU
	—	—	—	5 [♦]	7.8	—	6.2	7.6 [♦]	ATV58HU54N4XZU [▲]
	5	—	5 [*]	7.5 [♦]	10.5	—	7.6 [*]	11 [♦]	ATV58HU72N4XZU [▲]
	7.5	—	7.5 [*]	10 [♦]	13	—	11 [*]	14 [♦]	ATV58HU90N4XZU [▲]
	10	—	10 [*]	15 [♦]	17.6	—	14 [*]	21 [♦]	ATV58HD12N4XZU [▲]
	15	—	15 [*]	20 [♦]	24.2	—	21 [*]	27 [♦]	ATV58HD16N4XZU [▲]
	20	—	20 [*]	25 [♦]	33	—	27 [*]	34 [♦]	ATV58HD23N4XZU [▲]
	25	20	25/30	25	40.7	33	34/40	34	ATV58HD28N4XZU [▲]
	30	25	40	30	48.4	40.7	52	40	ATV58HD33N4XZU [▲]
	40	30	50	40	66	48.4	65	52	ATV58HD46N4XZU [▲]
	50	40	60	50	79.2	66	77	65	ATV58HD54N4XZU [▲]
	60	50	75	60	93.5	79.2	96	77	ATV58HD64N4XZU [▲]
	75	60	100	75	115.5	93.5	124	96	ATV58HD79N4XZU [▲]
	...	...	125	...	...	...	156	...	ATV58HC10N4XZU
	...	...	150	...	...	...	180	...	ATV58HC13N4XZU
	...	...	200	...	...	...	240	...	ATV58HC15N4XZU
	...	...	250	...	...	...	302	...	ATV58HC19N4XZU
	...	...	300	...	...	...	361	...	ATV58HC23N4XZU
...	...	350	...	...	...	414	...	ATV58HC25N4XZU	
...	...	400	...	...	...	477	...	ATV58HC28N4XZU	
...	...	450	...	...	...	515	...	ATV58HC31N4XZU	
...	...	500	...	...	...	590	...	ATV58HC33N4XZU	

- Abbreviations: CT = constant torque CTLN = constant torque, low noise; VT = variable torque; VTLN = variable torque, low noise.
- ▲ If an EMC filter to meet level A compliance is desired, delete the X from the catalog number.
- * These ratings encompass all 400/460 Vac applications with or without an EMC filter. For 460 Vac applications without an EMC filter, these ratings would be the same as the ratings in the VTLN columns.
- ♦ These products, without EMC filters, are for 460 Vac applications and can be used at the motor power and output current ratings provided in the VTLN columns. For 400 Vac applications, or if an EMC filter is required, delete the X from the catalog number and use the motor power and output current ratings provided in the CT and VT columns. Do not use the VTLN ratings denoted with the ♦ symbol.



ATV58 Family.tif

Available Type FVC Models

Input Line Voltage	3-Phase Motor Power (HP)		Continuous Output Current (A)	Catalog No. with Keypad ^[2]
	CT ^[1]		CT ^[1]	
400/460 Vac -15%/+20% 3-Phase	1		2.3	ATV58FHU18N4KU
	2		4.1	ATV58FHU29N4KU
	3		5.8	ATV58FHU41N4KU
	4		7.8	ATV58FHU54N4KU
	5		10.5	ATV58FHU72N4KU
	7.5		13	ATV58FHU90N4KU
	10		17.6	ATV58FHD12N4KU
	15		24.2	ATV58FHD16N4KU
	20		33	ATV58FHD23N4KU
	25		40.7	ATV58FHD28N4KU
	30		48.4	ATV58FHD33N4KU
	40		66	ATV58FHD46N4KU
	50		79.2	ATV58FHD54N4KU
	60		93.5	ATV58FHD64N4KU
75		115.5	ATV58FHD79N4KU	

[1] Abbreviations: CT = constant torque CTLN = constant torque, low noise.

[2] An EMC filter to meet level A compliance is included in this product. The Type FVC product ships with a keypad.

Available Type E Models



ATV58 NEMA 4 b, w no back.tif

Input Line Voltage	Constant Torque		Output Current	Catalog Number without Keypad
	Horsepower	Kilowatts	Amperes	
208/230 Vac Single-Phase	0.5	0.37	2.3	ATV58EU09M2ZU
	1	0.75	4.1	ATV58EU18M2ZU
	2	1.5	7.8	ATV58EU29M2ZU
	3	2.2	11	ATV58EU41M2ZU
208/230 Vac 3-Phase	2	1.5	7.8	ATV58EU29M2ZU
	3	2.2	11	ATV58EU41M2ZU
400/460 Vac 3-Phase	1	0.75	2.3	ATV58EU18N4ZU
	2	1.5	4.1	ATV58EU29N4ZU
	3	2.2	5.8	ATV58EU41N4ZU
	4	3	7.8	ATV58EU54N4ZU
	5	4	10.5	ATV58EU72N4ZU
	7.5	5.5	13	ATV58EU90N4ZU

Available Type F Models



ATV58 NEMA 4 b, w no back.tif

Input Line Voltage	Constant Torque		Output Current	Catalog Number without Keypad
	Horsepower	Kilowatts	Amperes	
208/230 Vac Single-Phase	0.5	0.37	2.3	ATV58EU09M2FZU
	1	0.75	4.1	ATV58EU18M2FZU
	2	1.5	7.8	ATV58EU29M2FZU
	3	2.2	11	ATV58EU41M2FZU
208/230 Vac 3-Phase	2	1.5	7.8	ATV58EU29M2FZU
	3	2.2	11	ATV58EU41M2FZU
400/460 Vac 3-Phase	1	0.75	2.3	ATV58EU18N4FZU
	2	1.5	4.1	ATV58EU29N4FZU
	3	2.2	5.8	ATV58EU41N4FZU
	4	3	7.8	ATV58EU54N4FZU
	5	4	10.5	ATV58EU72N4FZU
	7.5	5.5	13	ATV58EU90N4FZU

Altivar® 58 TRX AC Drives Selection



ATV58 NEMA4X2L_w no back.tif

Available Type N Models

Input Line Voltage	Constant Torque		Output Current	Catalog Number without Keypad
	Horsepower	Kilowatts	Amperes	
208/230 Vac Single-Phase	0.5	0.37	2.3	ATV58NU09M2KU
	1	0.75	4.1	ATV58NU18M2KU
	2	1.5	7.8	ATV58NU29M2KU
	3	2.2	11	ATV58NU41M2KU
208/230 Vac 3-Phase	2	1.5	7.8	ATV58NU29M2KU
	3	2.2	11	ATV58NU41M2KU
	—	3	13.7	ATV58NU54M2KU
	5	4	18.2	ATV58NU72M2KU
400/460 Vac 3-Phase	1	0.75	2.3	ATV58NU18N4KU
	2	1.5	4.1	ATV58NU29N4KU
	3	2.2	5.8	ATV58NU41N4KU
	5	4	10.5	ATV58NU72N4KU
	7.5	5.5	13	ATV58NU90N4KU
	10	7.5	17.6	ATV58ND12N4KU



OpInterfaceNew.tif

Operator Interface Options

Options (Field Installed)

Option	Description	For Use On:	Catalog Number
Operator Interface	Keypad Keypad Remote Mount Kit (IP65 Rating) PowerSuite Software for PC and PPC PC Cable Connection Kit to Connect PC to Drive Pocket PC Connection Kit to Connect PPC to Drive Closing Plate Kit Keypad Mount Kit	All ATV58 models Only ATV58 Type H and FVC All ATV58 models All ATV58 models All ATV58 models Only ATV58 Type N Only ATV58 Type N	VW3A58101U VW3A58103 VW3A8104 VW3A8106 VW3A8111 VW3A58836 VW3A58837
I/O Extension Cards	Analog I/O Option Card <i>Provides 2 logic inputs, 1 logic output, 1 analog output, and 1 bipolar analog input.</i>	All ATV58 models	VW3A58201U
	Digital I/O Option Card <i>Provides 2 logic inputs, 1 logic output, 1 analog output, and A-, B-, B- logic inputs for encoder speed feedback.</i>	All ATV58 models	VW3A58202U
Application Option Cards	Pump Switching Card <i>Sequences up to five pumps with one drive controller</i>	ATV58 Type E, F, H, and N	VW3A58210U
	115 Vac ATV58 TRX Logic Input Module <i>Provides 115 Vac conversion for logic inputs LI1, LI2, LI3, & LI4</i>	ATV58 Type H and N	VW3A58275U
0–10 V to 4–20 mA Converter	Converts a 0–10 V analog voltage signal to a 4–20 mA analog current signal.	ATV58 Type H and N	31158-297-50
Communication	FIPIO Communication Card Modbus+ Communication Card Modbus/Unitelway Communication Card Interbus S Communication Card AS-i Communication Card RS-485 Cable with Modbus Mapping Guide Profibus DP Communication Card CANopen Communication Card Device Net Communication Card Ethernet Modbus TCP/IP Communication Card FIPIO Communication Card LonWorks to Modbus DIN Rail Mount Gateway Johnson Controls N2 Communication Card	ATV58 Type E, F, H, and N ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type E, F, H, N, and FVC ATV58 Type H 125–500 hp & FVC ATV58 Type E, F, H, and N ATV58 Type E, F, H, and N	VW3A58301U VW3A58302U VW3A58303U VW3A58304EU VW3A58305 VW3A58306U VW3A58307U VW3A58308 VW3A58309U VW3A58310U VW3A58311U VW3A58312PU VW3A58354U
Fan Kit	Ventilation Fan Kit <i>These kits mount directly to the top of the ATV58 Type FVC and Type H controllers and are powered from the controller.</i>	ATV58•U09M2, U18M2	VW3A58821
		ATV58•U29M2, U41M2 ATV58•U18N4, U29N4, U41N4	VW3A58822
		ATV58•U54M2, U72M2 ATV58•U54N4, U72N4, U90N4	VW3A58823
		ATV58•U90M2, D12M2 ATV58•D12N4, D16N4, D23N4	VW3A58824
		ATV58•D16M2, D23M2 ATV58•D28N4, D33N4, D46N4	VW3A58825
		ATV58•D28M2, D33M2, D46M2 ATV58•D54N4, D64N4, D79N4	VW3A58826



I_O cards_b_w no back.tif

I/O Extension Cards



com cards_b_w no back.tif

Communication Options



fans_b_w no back.tif

Ventilation Fan Kits

Options (Field Installed) (Continued)



DB Resistor Kits

DynBrake.tif



Conduit Entrance Kits

conduit boxes b...w no back.tif

Option	Description	For Use On:	Catalog Number
Braking Components	DB Transistor	ATV58•U09M2, U18M2	VW3A58701
	Protected DB Resistors in Type 1 Enclosure <i>For use on ATV58 Type E, F, FVC, H and N.</i>	ATV58•U09M2, U18M2 ATV58•U18N4, U72N4	VW3A66711
		ATV58•U29M2, U41M2 ATV58•U90N4, D12N4	VW3A66712
		ATV58•U54M2, U72M2 ATV58•UD16N4, D23N4	VW3A66713
		ATV58•U90M2, D12M2 ATV58•D28N4, D33N4, D46N4	VW3A66714
		ATV58•D16M2, D23M2 ATV58•D54N4	VW3A66715
		ATV58•U28M2, D33M2, D46M2 ATV58•D64N4, D79N4	VW3A66716
Hardware	Line Reactor for Single Phase Input <i>IP00 rating.</i>	ATV58•U09M2, •U18M2, •U29M2, •U41M2,•U72M2	VW3A58501
		ATV58•U90M2, •D12M2	VW3A58502
	EMC Wiring Plate <i>Assists in compliance with Level A EMC directive; the plates are used to land the shield of shielded motor cables. For use on ATV58 Type FVC and Type H.</i>	ATV58•U09M2, U18M2	VW3A58831
		ATV58•U29M2, U41M2 ATV58•U18N4, U29N4, U41N4	VW3A58832
		ATV58•U54M2, U72M2 ATV58•U54N4, U72N4, U90N4	VW3A58833
		ATV58U90M2, D12M2 ATV58•D12N4, D16N4, D23N4	VW3A58834
	Conduit Entrance Kit <i>These kits have various size knockouts to land conduit and provide wire bending space to wire line and load cables. For use on ATV58 Type FVC and Type H.</i>	ATV58•U09M2, U18M2	VW3A58842
		ATV58•U29M2, U41M2 ATV58•U18N4, U29N4, U41N4	VW3A58843
		ATV58•U54M2, U72M2 ATV58•U54N4, U72N4, U90N4	VW3A58844
		ATV58•U90M2, D12M2 ATV58•D12N4, D16N4, D23N4	VW3A58845
		ATV58•D16M2, D23M2 ATV58•D28N4, D33N4, D46N4	VW3A58846
		ATV58•D28M2, D33M2, D46M2 ATV58•D54N4, D64N4, D79N4	VW3A58847
		ATV58HC10N4X	VW3A58848
		ATV58HC13N4X, C15N4X, C19N4X	VW3A58849
		ATV58HC23N4X, C25N4X, C28N4X, C31N4X, C33N4X	VW3A58850

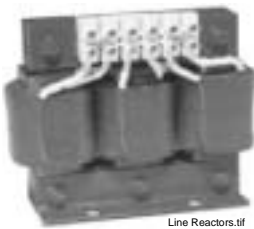
Altivar® 58 TRX AC Drives Selection

External RFI Input Filters

Supply Voltage	ATV58 Models	Maximum Length of Shielded Cable ^[1]		Nominal Current (In) of the Filter	Weight	Catalog Number
		EN 55011 Class A	EN 55022 Class B			
Single-Phase 200 to 240 Vac 50/60 Hz	ATV58•U09M2, ATV58•U18M2	50 m/164 ft	20 m/65 ft	10 A	1.7 kg/3.7 lb	VW3A58401
	ATV58•U29M2, ATV58•U41M2	50 m/164 ft	20 m/65 ft	25 A	3.6 kg/7.9 lb	VW3A58402
	ATV58•U72M2	50 m/164 ft	20 m/65 ft	25 A	5.0 kg/11.0 lb	VW3A58403
	ATV58•U90M2, ATV58•D12M2	50 m/164 ft	20 m/65 ft	40 A	10.0 kg/22.0 lb	VW3A58404
3-Phase 200 to 240 Vac 50/60 Hz	ATV58•U29M2, ATV58•U41M2	50 m/164 ft	20 m/65 ft	25 A	3.6 kg/7.9 lb	VW3A58402
	ATV58•U54M2, ATV58•U72M2	50 m/164 ft	20 m/65 ft	25 A	5.0 kg/11.0 lb	VW3A58403
	ATV58•U90M2, ATV58•D12M2	50 m/164 ft	20 m/65 ft	45 A	10.0 kg/22.0 lb	VW3A58404
3-Phase 208 to 240 Vac 50/60 Hz	ATV58HD16M2X, ATV58HD23M2X	n/a	n/a	80 A	13.0 kg/28.6 lb	VW3A58407
	ATV58HD28M2X, ATV58HD33M2X, ATV58HD46M2X	n/a	n/a	160 A	20.0 kg/44.0 lb	VW3A58408
3-Phase 400 to 460 Vac 50/60 Hz	ATV58•U18N4, ATV58•U29N4, ATV58•U41N4	50 m/164 ft	20 m/65 ft	25 A	3.6 kg/7.9 lb	VW3A58402
	ATV58•U54N4, ATV58•U72N4, ATV58•U90N4	50 m/164 ft	20 m/65 ft	25 A	5.0 kg/11.0 lb	VW3A58403
	ATV58•D12N4, ATV58•D16N4	50 m/164 ft	20 m/65 ft	45 A	10.0 kg/22.0 lb	VW3A58404
	ATV58•D23N4	50 m/164 ft	20 m/65 ft	45 A	13.0 kg/28.6 lb	VW3A58405
	ATV58HD28N4	200 m/656 ft	100 m/328 ft	50 A	13.0 kg/28.6 lb	VW3A58406
	ATV58HD33N4, ATV58HD46N4	200 m/656 ft	100 m/328 ft	80 A	13.0 kg/28.6 lb	VW3A58407
	ATV58HD54N4, ATV58HD64N4, ATV58HD79N4	200 m/656 ft	100 m/328 ft	160 A	20.0 kg/44.0 lb	VW3A58408

[1] The filter selection tables give the maximum length for the shielded cables which connect the motors to the drive controllers for a switching frequency of 0.5 to 12 kHz. These limits are given for information only as they depend on the interference capacity of the motors and the cables used. For motors connected in parallel, the total of the lengths must be taken into account.

Line Reactors—480 V Rated Three Phase



Line Reactors.tif

Line Reactors

460 V Drive Rating		Open Style Part Number	Enclosed Part Number	Approx. Wt. (lbs.)	Enclosure Dimensions HxWxD (in.)
HP	kW				
1	...	RL00202	RL00212	11	8x8x6
2-3	...	RL00403	RL00413	12	8x8x6
5	...	RL00803	RL00813	18	15x13x13
7.5	...	RL01203	RL01213	25	15x13x13
10	...	RL01803	RL01813	49	15x13x13
15	...	RL02503	RL02513	49	15x13x13
20-25	...	RL03503	RL03513	61	15x13x13
30	...	RL04503	RL04513	70	15x13x13
40	...	RL05503	RL05513	72	15x13x13
50-60	...	RL08003	RL08013	86	15x13x13
75	...	RL10003	RL10013	105	15x13x13
100	...	RL13003	RL13013	105	15x13x13
125	...	RL16003	RL16013	105	15x13x13
150	...	RL20003	RL20013	131	15x13x13
200	...	RL25003	RL25013	185	24x17x17
250	...	RL32003	RL32013	235	24x17x17
300	...	RL40003	RL40013	245	24x17x17
350-400	...	RL50003	RL50013	335	24x17x17
450-500	...	RL60003	RL60013	335	24x17x17

NOTE: Line reactors and filters are intended for separate mounting and wiring by the user. Ratings are based on NEC (NFPA 70) 430-150 current ratings. If the drive has a higher FLA rating, use the "A" rating to select the appropriate filter.

Line Reactors—208/230 V Rated Three Phase

208 V Drive Rating		230 V Drive Rating		Open Style Part Number	Enclosed Part Number (NEMA Type 1)	Approx. Wt. (lbs.)	Enclosure Dimensions HxWxD (in.)
HP	kW	HP	kW				
1	...	1	...	RL00402	RL00412	11	8x8x6
1.5–2	...	1.5–2	...	RL00802	RL00812	15	8x8x6
3	...	3	...	RL01202	RL01212	17	8x8x6
5	...	5	...	RL01802	RL01812	19	8x8x6
7.5	...	7.5	...	RL02502	RL02512	45	15x13x13
10	...	10	...	RL03502	RL03512	47	15x13x13
15	...	15	...	RL04502	RL04512	59	15x13x13
20	...	20	...	RL05502	RL05512	59	15x13x13
25	...	25–30	...	RL08002	RL08012	82	15x13x13
30	...	40	...	RL10002	RL10012	82	15x13x13
40	...	50	...	RL13002	RL13012	88	15x13x13
50	RL16002	RL16012	88	15x13x13

Line Reactors—208/230 V Rated Single Phase

208 V Drive Rating		230 V Drive Rating		Open Style Part Number	Enclosed Part Number (NEMA Type 1)	Approx. Wt. (lbs.)	Enclosure Dimensions HxWxD (in.)
HP	kW	HP	kW				
.55–1	...	RL00802	RL00812	15	8x8x6
1	...	2	...	RL01202	RL01212	17	8x8x6
2	...	3	...	RL01802	RL01812	19	8x8x6
3	RL02502	RL02512	45	15x13x13
...	3	...	3	RL03502	RL03512	47	15x13x13
5	...	5	...	RL04502	RL04512	59	15x13x13
7.5	...	7.5	...	RL08002	RL08012	82	15x13x13

480 V Rated Type 1 Enclosed Motor Protection Output Filters (UL508A)



Output Filters.tif

Output Filters

HP	Drive 460 V Rating	A	KLCUL Filter Enclosed Part Number	Approx. Wt. (lbs.)	Enclosure Dimensions					
					H		W		D	
					in.	mm	in.	mm	in.	mm
1–2		4	KLCUL4A1	15	12.25	311	12.50	318	6.75	171
3		6	KLCUL6A1	15	12.25	311	12.50	318	6.75	171
5		8	KLCUL8A1	15	12.25	311	12.50	318	6.75	171
7.5		12	KLCUL12A1	15	12.25	311	12.50	318	6.75	171
10		16	KLCUL16A1	17	12.25	311	12.50	318	6.75	171
15		25	KLCUL25A1	20	12.25	311	12.50	318	6.75	171
20–25		35	KLCUL35A1	20	12.25	311	12.50	318	6.75	171
30		45	KLCUL45A1	20	12.25	311	12.50	318	6.75	171
40		55	KLCUL55A1	20	12.25	311	12.50	318	6.75	171
50–60		80	KLCUL80A2	56	19.13	486	15.50	394	15.50	394
75		110	KLCUL110A2	60	19.13	486	15.50	394	15.50	394
100		130	KLCUL130A2	66	19.13	486	15.50	394	15.50	394
125		160	KLCUL160A2	80	19.13	486	15.50	394	15.50	394
150		200	KLCUL200A3	102	22.13	562	20.50	521	24.37	619
200		250	KLCUL250A3	110	22.13	562	20.50	521	24.37	619
250		300	KLCUL300A3	115	22.13	562	20.50	521	24.37	619
300		360	KLCUL360A3	125	22.13	562	20.50	521	24.37	619
350		420	KLCUL420A3	145	22.13	562	20.50	521	24.37	619
400		480	KLCUL480A3	150	22.13	562	20.50	521	24.37	619
450–500		600	KLCUL600A3	167	22.13	562	20.50	521	24.37	619

NOTE: Line reactors and filters are intended for separate mounting and wiring by the user. Ratings are based on NEC (NFPA 70) 430-150 current ratings. If the drive has a higher FLA rating, use the "A" rating to select the appropriate filter.

Altivar® 58 TRX AC Drives Selection

Spare Parts List for ATV58 TRX Controllers

	Description	For Use on Drives	Catalog Number
	ATV58 TRX Control Board Kit	ATV58 Type H, 125–500 hp only	VX4A381U
		ATV58 Type E, F, H and N	VX4A581U
Internal fan kit	Frames 2 and 3 (two fans)	ATV58 ..U29M2, U41M2, U54M2, U72M2, U18N4, U29N4, U41N4, U54N4, U72N4, U90N4	VZ3V58223U
	Frames 4 and 5 (three fans)	ATV58 ..U90M2, D12M2, D12N4, D16N4, D23N4	VZ3V58245U
	Frame 6 (four fans)	ATV58 ..D16M2, D23M2, D28N4, D33N4, D46N4	VZ3V58260U
	Frame 7 (four fans)	ATV58 ..D28M2, D33M2, D46M2 D54N4, D64N4, D79N4	VZ3V58270U
Terminals	Removable ATV58 TRX Control Board Terminal Strips (includes relay terminal strip and 9- and 10-position terminal strips)	ATV58 Type E, F, H, and N	VZ3N581U
	Power Terminal Block for Frame 6	ATV58 ..D16M2, D28N4, D33N4	VZ3N58160U
		ATV58 ..D23M2, D46N4	VZ3N58165U
Power Terminal Block for Frame 7	ATV58 ..D28M2, D33M2, D46M2 D54N4, D64N4, D79N4	VZ3N58170U	
Internal EMC Filter Kit	Internal RFI Filter Kit for Frame 6	ATV58HD28N4	VX4A58861U
		ATV58HD33N4	VX4A58862U
		ATV58HD46N4	VX4A58863U
	Internal RFI Filter Kit for Frame 7	ATV58HD54N4	VX4A58871U
		ATV58HD64N4	VX4A58872U
		ATV58HD79N4	VX4A58873U
Power Boards for Frames 6 and 7		ATV58HD16M2	VX5A58D16M2U
		ATV58HD23M2	VX5A58D23M2U
		ATV58HD28M2	VX5A58D28M2U
		ATV58HD33M2	VX5A58D33M2U
		ATV58HD46M2	VX5A58D46M2U
		ATV58HD28N4	VX5A58D28N4U
		ATV58HD33N4	VX5A58D33N4U
		ATV58HD46N4	VX5A58D46N4U
		ATV58HD54N4	VX5A58D54N4U
		ATV58HD64N4	VX5A58D64N4U
	ATV58HD79N4	VX5A58D79N4U	
Power Components	Output Transistor Module	ATV58...D28N4	VZ3IM6075M1258U
		ATV58...D16M2, D33N4	VZ3IM6100M1258U
		ATV58...D23M2, D28M2, D46N4, D54N4	VZ3IM6150M1258U
		ATV58...D33M2, D46M2, D64N4, D79N4	VZ3IM2200M1258U
	Dynamic Braking Transistor	ATV58..D16M2, D23M2, D28N4, D33N4, D46N4	VZ3IM1050M1258U
		ATV58...D28M2, D54N4	VZ3IM1100M1258U
		ATV58...D33M2, D46M2, D64N4, D79N4	VZ3IM1150M1258U
	Input Diode / Transistor Bridge	ATV58...D16M2, D28N4, D33N4	VZ3TD1055M1658U
		ATV58...D23M2, D28M2, D46N4, D54N4	VZ3TD1090M1658U
ATV58...D33M2, D46M2, D64N4, D79N4		VZ3TD1130M1658U	

Spare Parts for ATV58HC10N4 to ATV58HC33N4

Description	Model Numbers	Contents	Catalog No.
Control board	ATV58HC10N4–HC33N4	Control board + option support + light ducting + 2 sub-D pins + connector shield for option card PWB1	VX4A381
Interface board	ATV58HC10N4–HC33N4	1 I/F interface board PWB7	VX4A382
Gate drive board	ATV58HC10N4–HC33N4	1 gate drive board VFA7D-0585Z PWB3	VX5A38C10
Gate board	ATV58HC10N4	1 gate drive VFA7D-4595A PWB5	VX5A38C11
Current gain board	ATV58HC10N4	1 current gain board VF7X-2680A PWB6	VX5A38C12
	ATV58HC13N4, HC15N4, HC25N4	1 current gain board VF7X-2680B PWB6	VX5A38C13
	ATV58HC19N4	1 current gain board VF7X-2680C PWB6	VX5A38C14
	ATV58HC23N4–HC28N4	1 current gain board VF7X-2680D PWB6	VX5A38C15
	ATV58HC31N4	1 current gain board VF7X-2680E PWB6	VX5A38C16
	ATV58HC33N4	1 current gain board VF7X-2680F PWB6	VX5A38C17
Contactor kit	ATV58HC10N4	1 contactor S-N65 + 1 filter RFM2E224KD	VY1A38101
	ATV58HC13N4	1 contactor S-N65 + 1 filter RFM2E224KD	VY1A38102
	ATV58HC15N4–HC19N4	1 contactor C-80A + 1 filter RFM2E224KD	VY1A38103
	ATV58HC23N4–HC33N4	1 contactor C-180A + 1 filter RFM2E224KD	VY1A38104
Current transformer	ATV58HC10N4	1 current transformer HC-SL212V4B15CA, 212AT-4V	VY1A38111
	ATV58HC13N4	1 current transformer HC-SL300V4B15CA, 300AT-4V	VY1A38112
	ATV58HC15N4–HC19N4	1 current transformer HC-SL360V4B15CA, 360AT-4V	VY1A38113
	ATV58HC23N4–HC25N4	1 current transformer HC-MSN590V4B15G, 590AT-4V	VY1A38114
	ATV58HC28N4–HC33N4	1 current transformer HC- MSN760V4B15G, 760AT-4V	VY1A38115
Power supply board	ATV58HC10N4–HC33N4	1 power supply board VFA7D-1877C PWB2	VY1A38120
Insulating sheets	ATV58HC10N4	Size 8 insulating sheets	VY1A38210
	ATV58HC13N4–HC19N4	Size 9 insulating sheets	VY1A38211
	ATV58HC23N4–HC33N4	Size 10 insulating sheets	VY1A38212
Thermal grease	ATV58HC10N4–HC33N4	35ml thermal grease	VY1A58856
Screw kit	ATV58HC10N4	Screw kit for 90 KW	VY1ADV384
	ATV58HC13N4	Screw kit for 110 KW	VY1ADV385
	ATV58HC15N4	Screw kit for 132 KW	VY1ADV386
	ATV58HC19N4	Screw kit for 160 KW	VY1ADV387
	ATV58HC23N4–HC25N4	Screw kit for 200-220 KW	VY1ADV388
	ATV58HC28N4–HC33N4	Screw kit for 250-280-315 KW	VY1ADV389
Capacitor kit	ATV58HC10N4	1 metal support + 4 resistors 40W/21Kohms + 4 capacitors 400V/8200µF + 2 insulating sheets + 1 copper bar kit + cables J752/CN91 + 12 screws	VZ3C3810
	ATV58HC13N4–HC19	1 metal support + 6 resistors 40W/21Kohms + 6 capacitors 400V/8200µF + 1 insulating sheet + 1 copper bar kit + cables J752/CN91 + 18 screws	VZ3C3811
	ATV58HC23N4–HC25N4	2 main metal supports + 2 capacitor metal supports + 16 resistors 40W/21Kohms + 8 capacitors 400V/8200µF + 1 copper bar kit + cables J752/CN91 + 24 screws	VZ3C3812
	ATV58HC28N4–HC33N4	2 main metal supports + 2 capacitor metal supports + 20 resistors 40W/21Kohms + 8 capacitors 400V/8200µF + 1 copper bar kit + cables J752/CN91 + 24 screws	VZ3C3813
Input diode bridge	ATV58HC10N4–HC33N4	1 diode bridge DD240KB160	VZ3D381
Input filter	ATV58HC10N4–HC33N4	1 filter VCR1005	VZ3D382
Power fuse	ATV58HC10N4	1 fuse 6.6URD30TTF0350	VZ3F3801
	ATV58HC13N4–HC19N4	1 fuse 6.6URD30TTF0550	VZ3F3802
	ATV58HC23N4–HC25N4	1 fuse 6.6URD32TTF1000	VZ3F3803
	ATV58HC28N4–HC33N4	1 fuse 6.6URD32TTF0900	VZ3F3804
Control fuse	ATV58HC10N4–HC19N4	1 fuse 314 003	VZ3F3820
	ATV58HC23N4–HC33N4	1 fuse 314 005	VZ3F3821
Thermal sensor	ATV58HC10N4–HC33N4	1 thermal sensor EF6F203A2-02014	VZ3G381
Output transistor	ATV58HC10N4	1 transistor MG400Q2YS60A	VZ3I381

Altivar® 58 TRX AC Drives Selection

Spare Parts for ATV58HC10N4 to ATV58HC33N4 (Continued)

Output transistor kit	ATV58HC13N4–HC19N4	2 transistors MG400Q2YS60A + 1 board VFA7D-4596A + 2 metal supports + 16 screws	VZ3I382
	ATV58HC23N4–HC25N4	4 transistors MG400Q2YS60A + 2 boards VFA7D-4596A + 4 metal supports + 2 cables + 32 screws	VZ3I383
	ATV58HC28N4–HC33N4	5 transistors MG400Q2YS60A + 1 board VFA7D-4596A + 1 board VFA7D-4597A + 4 metal supports + 2 cables + 39 screws	VZ3I384
Internal cable kit	ATV58HC10N4	Cable kit for Size 8	VZ3N3808
	ATV58HC13N4–HC19N4	Cable kit for Size 9	VZ3N3809
	ATV58HC23N4–HC33N4	Cable kit for Size 10	VZ3N3810
Pre-charge resistor	ATV58HC10N4	1 metal support + 2 resistors 80W + 1 filter VCR1005 460 V AC + 1 OHD3-90M + 1 insulating sheet + 9 screws	VZ3R3810
	ATV58HC13N4–HC19N4	1 metal support + 2 resistors 80W + 1 OHD3-90M + 1 insulating sheet + 4 screws	VZ3R3811
	ATV58HC23N4–HC33N4	1 metal support + 3 resistors 120W + 1 OHD3-90M + 1 insulating sheet + 5 screws	VZ3R3812
Control transformer	ATV58HC10N4	1 Size 8 control power transformer	VZ3TR381
	ATV58HC13N4–HC19N4	1 Size 9 control power transformer	VZ3TR382
	ATV58HC23N4–HC33N4	1 Size 10 control power transformer	VZ3TR383
Heatsink fans	ATV58HC10N4	Kit of 2 fans	VZ3V3808
	ATV58HC13N4–HC19N4	Kit of 3 fans	VZ3V3809
	ATV58HC23N4–HC33N4	Kit of 6 fans	VZ3V3810
Internal fan	ATV58HC10N4–HC19N4	1 fan	VZ3V3818
	ATV58HC19N4	1 fan	VZ3V3819
	ATV58HC23N4–HC33N4	Kit of 2 fans	VZ3V3820

SUGGESTED SPECIFICATIONS FOR ATV58 TYPE H CONTROLLERS

NOTE: These specifications are for adjustable frequency drive controllers or herein referred to as AC drives. The Construction Specifications Institute (CSI) format has been conformed with for project compatibility. Copies of this specification are available on IBM floppy disk or 100% IBM compatible formats as well as Macintosh configurations. Application information directly affects the type and size of AC drive that will be quoted. Brackets are provided where such data should be included. Please call your local Square D distributor or sales engineer for specification assistance regarding a particular application. For better coordination, the AC drive specification should be included in Division 16 for Electrical Work.

PART 1: GENERAL

1.01 Scope of Work

- a. This section provides specification requirements for AC inverter type adjustable frequency, variable speed drives or herein identified as AC drives for use with [NEMA B, NEMA A, NEMA C, NEMA E, synchronous] design, AC motors.

1.02 Quality Assurance

- a. The AC drive and all options shall be UL Listed according to Underwriters Laboratories.
- b. The AC drive shall be designed, constructed, and tested in accordance with NEMA, ICS, NFPA, IEC standards and CSA certified.
- c. The manufacturer of the AC drive shall be a certified ISO 9002 facility.
- d. The AC Drive manufacturer shall offer 24 hour, 7 day product and application response via a nationwide network of factory certified technical support personnel.

1.03 Warranty

- a. A manufacturers warranty shall be provided on all materials and workmanship of no less than 1 year from the date of start-up or 18 months from date of shipment.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

- a. The AC drive shall be an Altivar 58 TRX supplied by the Schneider Electric /Square D Company or prior approved equal, no substitutions are permitted.

2.02 General Description

- a. The AC drive shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
- b. The input section shall contain a common mode choke and or an internal line reactor.
- c. The rectifier section shall convert fixed voltage, fixed frequency, AC line power to fixed DC voltage. The rectifier section shall utilize a full wave bridge design incorporating diode rectifiers. The rectifier shall be insensitive to phase rotation of the AC line. The DC voltage shall be filtered.
- d. The inverter section shall change fixed DC voltage to variable frequency AC. The inverter section shall utilize only intelligent power modules (IPMs) as required by the current rating of the motor.

2.03 Motor Data

- a. The AC drive shall be sized to operate a [NEMA design B] AC motor with a nameplate rating as defined in the National Electric Code, table 430-149, for the applicable horsepower.

Altivar® 58 TRX AC Drives

Suggested Specifications

2.04 Application Data

- a. The AC drive shall operate a [variable torque load, constant torque load, constant horsepower load, impact load].
- b. The speed range shall be from a minimum speed of 0.1 Hz @ 100% breakaway torque to a maximum speed of 500 Hz. The speed range shall be selectable at 50 Hz, 60 Hz, 200 Hz, 500 Hz.

2.05 Environmental Ratings

- a. The AC drive construction ½ HP to 5 HP 230 Vac and 1 HP to 7.5 HP 460 Vac shall be IP20/open according to Standard EN50178; models rated 7.5 HP to 10 HP 230 Vac and 10 HP to 20 HP 460 Vac shall be Type 1. Both are designed to operate as Pollution degree 2 conforming to IEC 60664-1, EN50718, and NEMA ICS-1 Annex A. Drives above 20 HP 460 Vac and 15 HP 230 Vac shall meet Type 1 Pollution degree 3 according to IEC 60664-1, EN50718, and NEMA ICS-1 Annex A.
- b. The AC drive will be designed to operate in an ambient temperature of 0 to 40 °C (32 to 104 °F).
- c. The storage temperature range shall be –25 to +70 °C (–13 to 158 °F).
- d. The maximum relative humidity shall be 95% at 40 °C (104 °F), non-condensing.
- e. The AC drive will be rated to operate at altitudes less than or equal to 1000 m (3,300 feet). For altitudes above 1000 m, derate the AC drive by 1.2% for every 100 m (330 feet).
- f. The AC drive will meet the IEC 68-2-6 vibration specification.
- g. The AC drive shall be designed and constructed to be of touch-safe construction with the enclosure open to operator access according to IP20 standards.

2.06 Ratings

- a. The AC drive shall be designed to operate from an input voltage of 208/230 ±15% Vac or 400/460 ±10% Vac.
- b. The AC drive shall operate from an input voltage frequency range from 47.5 to 63 Hz.
- c. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.
- d. The efficiency of the AC drive at 100% speed and load shall not be less than 96%.
- e. The constant torque overtorque capacity will be 150% for 1 minute [The variable torque overtorque capacity will be 110% for 1 minute].
- f. The output switching frequency of the drive will be randomly modulated and selectable at 2 kHz, 4 kHz, 8 kHz, 12 kHz, or 16 kHz depending on drive rating for low noise operation.
- g. The output frequency shall be from 0.1 to 500 Hz (selectable at 50 Hz, 60 Hz, 200 Hz, 500 Hz).
- h. The AC drive will be able to provide rated motor torque at 0.5 Hz in a Sensorless Flux Vector mode using a standard motor and no tachometer feedback.

2.07 Protection

- a. The AC drive design and all hardware options will meet IP20 standards and allow for touch-safe access with the front cover open for all AC drives.
- b. Upon power-up the AC drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, [dynamic brake failure], DC to DC power supply, control power, and the pre-charge circuit.
- c. The AC drive shall be protected against short circuits between output phases; between output phases and ground; on the control terminal outputs; and the internal supplies. The logic and analog outputs shall also be optically isolated.
- d. The AC drive shall have a minimum of power loss ride-through of 200 ms. The AC Drive shall have the user-defined option of frequency fold-back to increase the duration of the power-loss ride-through.
- e. The AC drive will have a selectable ride through function which will allow the logic to maintain control for a minimum of one second without faulting.

- f. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide restart.
- g. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop, and DC injection braking.
- h. A synchronized restart shall be provided that will catch a spinning motor by sensing the motor frequency and rotational direction and synchronize the AC drive's output prior to restarting.
- i. Upon loss of the analog process follower reference signal, the AC drive shall fault and/ or operate at a user defined speed set between software programmed low speed and high speed settings.
- j. The AC drive shall have solid state I₂t protection that is UL listed and meets UL 508 C as a Class 20 overload protection and meets IEC 60947. The adjustment shall be from 0.45 to 1.05 percent of the current output of the AC Drive.
- k. The AC Drive shall have a thermal switch with a user-selectable pre-alarm that will provide a minimum of 60 seconds delay before overtemperature fault.
- l. The AC Drive may utilize bonded fin heatsink construction for maximum heat transfer.
- m. The AC drive shall have a programmable fold-back function that will anticipate drive overload condition and fold back the switching frequency to avoid a fault condition.
- n. There shall be three skip frequencies that can each be programmed with a selectable bandwidth of ± 2.5 Hz, selectable anywhere in the speed range.

2.08 Adjustments and Configurations

- a. The AC drive shall have a user selectable Auto Tune feature. The Auto Tune will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation. The AC Drive will automatically optimize the operating characteristics according to the stored data.
- b. The AC drive will contain factory pre-set Macros in order to speed configuration of I/O for the most common applications. The Macro menu shall contain configurations for material handling, general use and variable torque.
- c. A choice of three types of acceleration and deceleration ramps will be available in the AC Drive software: linear, S curve and U curve.
- d. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.
- e. The volts per frequency ratios shall be user-selectable to meet quadratic torque loads, normal and high torque machine applications.
- f. The memory shall retain and record run status and fault type of the past 8 faults.
- g. Slip compensation shall be a software-enabled function.
- h. The software shall have a selectable energy savings function *nLd* (energy Eco) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.
- i. The AC drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50 and 150% of rated current and available from 0.0 to 30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.
- j. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the AC drive output, mechanical actuation, and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

Altivar® 58 TRX AC Drives

Suggested Specifications

2.09 Operator Interface

- a. The operator interface terminal will offer the modification of AC drive adjustments via a touch keypad. All electrical values, configuration parameters, drive menu parameters, application and activity function access, faults, local control, adjustment storage, self-test, and diagnostics will be shown. There will be a standard selection of four additional languages built-in to the operating software as standard.
- b. The display will be a high resolution, LED screen capable of displaying four 7-segment LED's for display of numerical values and codes in combination with a 16-character LCD display for messages.
- c. The AC drive keypad will announce horsepower and voltage.
- d. The display shall be capable to be configured to display multiple parameters with numeric data that is selectable and scalable by the operator. A user defined display value proportional to output frequency shall be available. As a minimum the display values shall consist of speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, motor thermal state, drive thermal state, motor speed, and process speed.
- e. The keypad must allow dynamic switching between display variables.
- f. The terminal keypad will provide the means of holding four different sets of drives parameters. The functions will allow both operating commands and programming options to be preset by the operator.
- g. A hardware selector switch will allow the terminal keypad to be locked out from unauthorized personnel.
- h. The keypad display will offer a general menu consisting of parameter setting, fault display, and drive configuration. A software lock will limit access to the main menu. The main menu will consist of keypad configuration, drive configuration, general configuration, diagnostic mode, and AC Drive initialization screens.
- i. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.
- j. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.
- k. An escape key will allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function will also return to a previous menu display.
- l. A RUN key and a STOP key will command a normal starting and stopping as programmed when the AC drive is in keypad control mode.
- m. The AC drive shall have 2 LED's mounted on the front panel to indicate functional status. A green LED will verify that the AC drive power supply is on. A red LED indicator will indicate an AC drive fault.
- n. A hand-held pocket PC operator interface shall be available for remote programming, diagnostics and troubleshooting, and I/O Map display of terminal connections. The hand-held pocket PC shall allow storage of eight drive set-up configurations, allow for the uploading and downloading of configurations between AC drives or to a personal computer. Memory shall be non-volatile
- o. A user interface shall be available that is Windows® software based for use with personal computer, serial communication link, or detachable operator interface.

2.10 CONTROL

- a. External pilot devices shall be able to be connected to a terminal strip for starting/stopping the AC Drive, speed control, and displaying operating status. Control inputs and outputs will be software assignable.
- b. 2-wire or 3-wire control strategy shall be defined within the software. External relays or logic devices will not be needed to implement 3-wire control.
- c. The control power for the digital inputs and outputs shall be 24 Vdc.
- d. The internal power supply incorporates an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current-limited and not be damaged if shorted or excess current is drawn.
- e. All logic connections shall be furnished on pull-apart terminal strips.

- f. There will be 2 analog inputs. 1 analog input will be software selectable and consist of the following configurations: 0-20 ma, 4-20 ma, 20-4 ma, x-20 ma (where x is user defined). The other analog input shall be 0-10 Vdc.
- g. There will be 4 isolated logic inputs, 3 shall be user assignable in the software. The selection of assignments, at a minimum, shall consist of run, reverse, jog, ramp switching, plus/minus speed (2 inputs required), setpoint memory, preset speeds (up to 8 speeds), auto/manual control, fast stop, forced local, motor switching, and fault reset.
- h. One voltage-free Form C relay output contacts will be provided to indicate AC drive fault status. An additional NO relay contact will be user assignable.
- i. There will be one analog output as standard that will be software selectable from 0–20 mA or 4–20 mA to represent a signal proportional to one of the following: motor current, motor speed, \pm torque, motor power, PI loop variables, drive or motor thermal states.
- j. There shall be available an additional hardware input/output extension card which also provides interlocking and sequencing capabilities. The card shall be fully isolated with pull apart terminal strips. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power, torque, and thermal state. The output signal will be selectable from 0-20 ma or 4-20 ma. All of the I/O will be user assignable in the software as previously defined.

2.11 Braking (Application-dependent Option)

NOTE: When braking certain types of loads, there is the conversion of kinematic energy into electrical energy by the motor which is returned to the AC drive. Dynamic braking can be chosen to absorb this energy and avoid causing the AC drive to inadvertently shut down. The energy is dissipated across a resistor that is connected to the drive. For constant torque AC drives, the dynamic braking unit must be capable of stopping 1.5 per unit motor torque from base frequency to 0.5 Hz with sensorless flux vector control mode.

- a. The dynamic brake resistor shall be provided and connect to existing terminals on the AC drive. The resistor shall mount externally to the AC drive enclosure. A power transistor will be provided in the AC drive to switch the excess energy to the braking resistor. The braking resistor will be of a size calculated to stop 6 times motor inertia at 1.5 per unit motor torque.

2.12 HARMONIC ANALYSIS

NOTE: The amount of harmonic distortion at the point of common coupling (PCC) is due to the distribution system characteristics (impedance of the source) and the power source size relative to the AC drive load. The harmonic current magnitude and voltage distortion values can be predicted through computer modeling. If the resulting calculations determine that the harmonic distortion will be above the IEEE-519 specifications of 5%, isolation transformers or line reactors can be supplied to lower the harmonic levels. The isolation transformers or line reactors are mounted at the AC drive input to reduce the current harmonics that are fed back into the supply.

- a. A harmonic analysis shall be performed and priced as a separate line item by the AC drive manufacturer based upon system documentation consisting of but not limited to one-line diagrams and specific distribution transformer information consisting of X/R,%Z, and kVA data. The data shall consist of but not be limited to total harmonic voltage distortion and total rms current.
- b. The maximum allowable input line unbalance shall be [5% for 460 V input line short circuit capacity of 15,000 amps] [2.5% for 460 V input line short circuit capacity of 30,000 amps] [.5% for 460 V input line short circuit capacity of 65,000 amps]. If the resulting voltage harmonic distortion exceeds 5%, three phase, line reactor(s) shall be priced as a separate line item.
- c. The line reactor(s) if required shall be provided in stand-alone Type 1 enclosures for mounting separately from the AC drive.

Altivar® 58 TRX AC Drives Suggested Specifications

PART 3: EXECUTION

3.01 Inspection

- a. Verify that the location is ready to receive work and the dimensions are as indicated.
- b. Verify that power is available to the AC drives prior to installation.

3.02 Protection

- a. Before and during the installation, the AC drive equipment shall be protected from site contaminants.

3.03 Installation

- a. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
- b. The AC drive manufacturer shall provide a factory-certified technical representative to supervise the contractor's installation, testing, and start-up of the AC drive(s) furnished under this specification for a maximum total of [] days. The start-up service shall be quoted as a separate line item.

3.04 Training

- a. An on-site training course of [] training days shall be provided by a representative of the AC drive manufacturer and quoted as a separate line item.

Class 8839 58M Enclosed AC Drives Contents



Class 8839 58M Enclosed AC Drives

DESCRIPTION	PAGES
GENERAL INFORMATION	144
DRIVE SELECTION	146
POWER CIRCUIT DESCRIPTIONS	148
STANDARD MODIFICATIONS	151
FACTORY ENGINEERED MODIFICATIONS	155
THREE PHASE LINE REACTORS	160
MOTOR PROTECTING OUTPUT FILTERS	161
THREE PHASE DRIVE ISOLATION TRANSFORMERS	162
DIMENSIONS AND WEIGHTS FOR MOUNTING	163
APPLICATION INFORMATION	170
SPECIFICATIONS	175

Class 8839 58M Enclosed AC Drives General Information

INTRODUCTION

Welcome to the Class 8839 58M Enclosed AC drive, the latest family of enclosed drive solutions from Square D incorporating the Altivar 58 TRX platform. The Class 8839 58M Enclosed AC drive provides a robust adjustable speed drive solution for a variety of commercial and industrial applications. The product features the rugged enclosure construction commonly expected by industrial users and specifiers. The Class 8839 58M Enclosed AC drive is a full featured product, designed for maximum flexibility and tailored to your customers' specifications. Square D offers a wide array of pre-engineered and customizable options that include control, power, and enclosure configurations. Typical options include industrial-rated control operators, circuit breaker disconnects, fully-rated isolation and bypass contactors, line reactors, motor protection filters, door-mounted keypad display, PowerLogic® monitoring, communication options, and construction that meets performance expectations.

Class 8839 58M Enclosed AC Drive Ratings

Class 8839 58M Enclosed AC drives are available at:

- 1–500 hp VT, 1–75 hp CT, @ 460 Vac and
- 1–50 hp VT, 1–40 hp CT, @ 208/230 Vac
- Consult Drives Product Support for CT ratings above 75 hp.

Standard and Engineered Options

Two option categories (Standard and E-Mods) allow Square D to balance customer requirements for cost effective, fast turn around orders with complex, highly engineered, customized motor control solutions. Standard options are pre-engineered and well defined with selection rules. Orders with standard options are supported by an automated drawing process which produces electronically generated “as built” customer documentation.

E-Mods (engineering options) require additional engineering effort to layout, define interoperability, and develop custom customer and manufacturing documentation. Standard enclosure dimensions may not apply to orders containing E-Mods. Orders containing E-Mods will have increased lead times.



ENCLOSURE TYPES

The Class 8839 58M Enclosed AC drive family is available in three enclosure designs. Enclosure designs are dependent on the horsepower, voltage, and options selected.

Wall Mount

Wall-mounted enclosures are provided as standard for 1–20 hp constant torque (CT) and 1–25 hp variable torque (VT) @ 460 Vac drives, and for 1–7.5 hp CT and 1–10 hp VT @ 208/230 Vac drives. The wall-mounted Class 8839 58M Enclosed drives are available in two enclosure sizes as follows with all standard options, including integrated full speed bypass, and Type 1 and Type 12 designs to meet application requirements:

- 460 V, 1–25 hp VT and 1–20 hp CT in Enclosure Size C
- 208/230 V, 1–5 hp VT and 1–5 hp CT in Enclosure Size C
- 208/230 V, 7.5–10 hp VT and 7.5–10 hp CT in Enclosure Size D

Class 8839 58M Enclosed AC Drives General Information

Floor Mount

Floor-mounted enclosures are provided as standard for 25–400 hp CT and 30–500 hp VT @ 460 Vac drives, and for 10–40 hp CT and 15–50 hp VT @ 208/230 Vac drives. The floor-mounted enclosures are available in five sizes.

Products up to 75 hp CT and 100 hp VT are available in two enclosure sizes as follows with all standard options, including integrated full speed bypass, and Type 1 and Type 12 designs to meet application requirements:

- 460 V, 30–50 hp VT and 25–40 hp CT; and 208/230 V, 15–25 hp VT and 15–20 hp CT in Enclosure Size E (20 in. wide enclosure)
- 460 V, 60–100 hp VT and 50–75 hp CT; and 208/230 V, 30–50 hp VT and 25–40 hp CT in Enclosure Size F (25 in. wide enclosure)

The 125–500 hp VT @ 460 Vac drives are available in three standard enclosure widths as follows:

- 460 V, 125 hp VT in a 25 in. wide enclosure
- 460 V, 150–250 hp VT in a 30 in. wide enclosure
- 460 V, 300–500 hp VT in a 35 in. wide enclosure
- Consult Drives Product Support for CT ratings above 75 hp.

Full speed bypass and the harmonic filter option require an additional 20 inches added to the standard enclosure width at the left side. Enclosures for drives above 100 hp are available in Type 1 and Type 1G designs with filters (fan and door gaskets) to meet application requirements.



Barriered

Barriered enclosures provide a compartmentalized AC drive and bypass solution by separating isolation and bypass contactors for the AC drive in separate compartments with disconnects for each motor controller. This provides maximum physical isolation between the two separate motor controllers, and provides maximum user flexibility when servicing a drive while remaining on bypass.

The floor-mounted barriered enclosures are available in three widths:

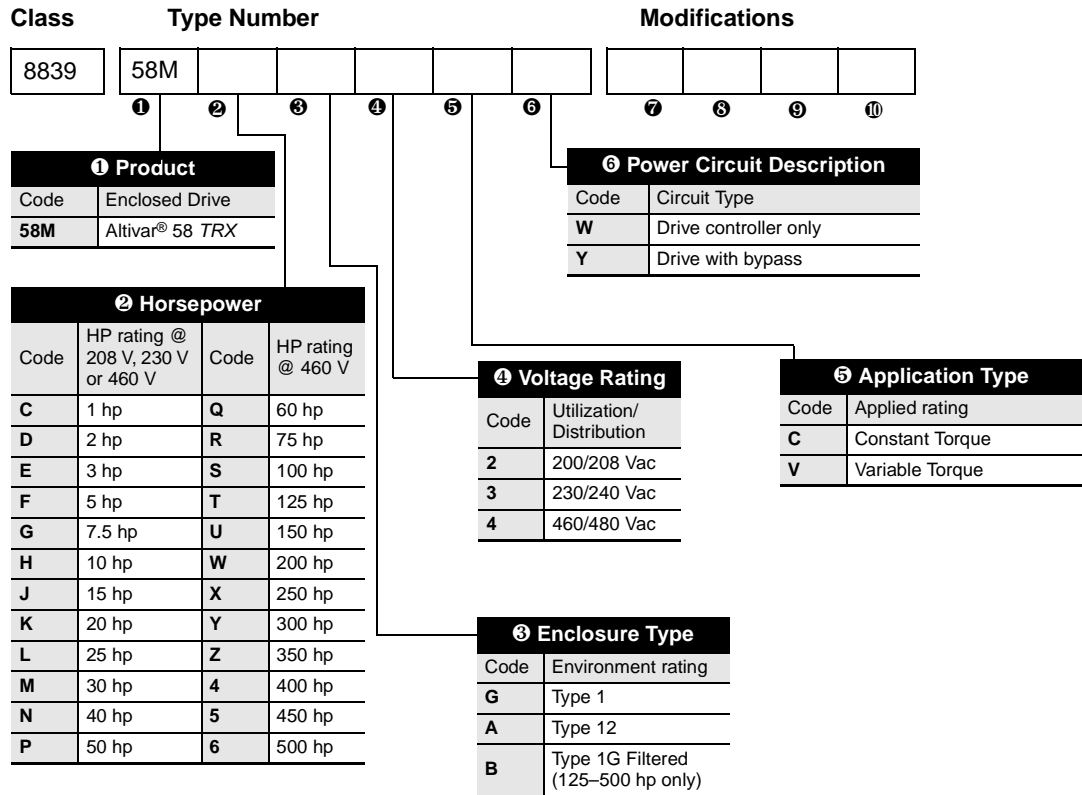
- 460 V, 1–25 hp VT and 1–20 hp CT; and 208/230 V, 1–10 hp VT and 1–10 hp CT in a 20 in. wide enclosure.
- 460 V, 30–50 hp VT and 25–40 hp CT; and 208/230 V, 15–25 hp VT and 15–20 hp CT in a 25 in. wide enclosure.
- 460 V, 60–100 hp VT and 50–75 hp CT; and 208/230 V, 30–50 hp VT and 25–40 hp CT in a 30 in. wide enclosure.

For 125 hp drives and higher, an additional 25 inches is added to the enclosure width at the right side.



Class 8839 58M Enclosed AC Drives Drive Selection

The Class 8839 58M Enclosed AC drive offers a feature rich platform of standard control functions and extensive options to meet the most demanding application and specification requirements. To select a Class 8839 58M Enclosed AC drive, identify the catalog number by Class, Type, and Modification number(s) as shown below:



Standard Features

- Circuit Breaker Disconnect
- UL508C listing with NEMA 1CS 7.1 compliance
- 65,000 AIC short circuit rating (1–100 hp) or 100,000 AIC short circuit rating (125–500 hp).
- Industrial vault style disconnect handle with lockout /tag-out provisions
- HAND-OFF-AUTO selector switch and manual speed spot
- Door-mounted keypad display
- Auto Start Relay (115-volt control)
- One Form C AFC Run mode contact
- One Form C AFC Fault contact
- Remote fault condition reset in AUTO mode with transition of auto start contact
- Manual fault condition reset in OFF position of H-O-A selector switch
- Safety interlock/Run permissive location wired to customer terminal strip
- Permanent Wire Markings
- White Component mounting Plate

- Conduit knockouts on top and bottom for wall mounted enclosures
- Removable conduit entry plates on top and bottom for floor mount enclosures
- ANSI 49 gray enclosure
- As-built wiring diagrams

Bypass Standard Features

- Class 20 Overload Protection with door-mounted reset
- AFC-OFF-BYPASS selector switch
- TEST-NORMAL selector switch
- Isolation and Bypass Contactors (with mechanical and electrical interlocking)
- Bypass and isolation contactor sequencing provides true motor isolation
- Remote automatic bypass operation using Auto Start Relay
- As-built wiring diagrams

Class 8839 58M Enclosed AC Drives Drive Selection

The following tables define the available factory modifications for the Class 8839 58M Enclosed AC Drives. These factory modifications offer maximum flexibility for many complex job specifications. All modifications follow specific interoperability rules for selection. Modification selection can be validated at time of quotation or order entry by the Square D Quote to Cash Product Selector.

⑦ Control Options	
Code	AFC Controls
A07	Hand/Off/Auto, Speed Potentiometer
B07	Hand/Off/Auto, Start/Stop, Speed Potentiometer
C07	Start/Stop, Speed Potentiometer
D07	Stop/Start, Forward/Reverse, Speed Potentiometer
E07	Hand/Off/Auto, Local/Remote, Speed Potentiometer
F07	Communication/Auto/Off/Hand, Speed Potentiometer

⑧ Light Options	
Code	Light cluster
A08	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Auto
B08	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Bypass
C08	Red Power On
	Green AFC Run
	Yellow AFC Fault
D08	Red Power On
	Yellow AFC Fault
	Green Run Forward
	Green Run Reverse
E08	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Blue Hand
	Yellow Auto
F08	Red Power On
	Green AFC Run
	Yellow AFC Fault
	Yellow Communication

⑨ Option Cards	
Code	Feature
A09	MODBUS® Plus
B09	MODBUS / UNITELWAY
C09	METASYS N2
D09	Ethernet
E09	LONWORKS Gateway
F09	DEVICENET
H09	Analog card adds 1 additional analog output, 2 additional logic inputs, 1 additional logic output, and 1 differential analog input.

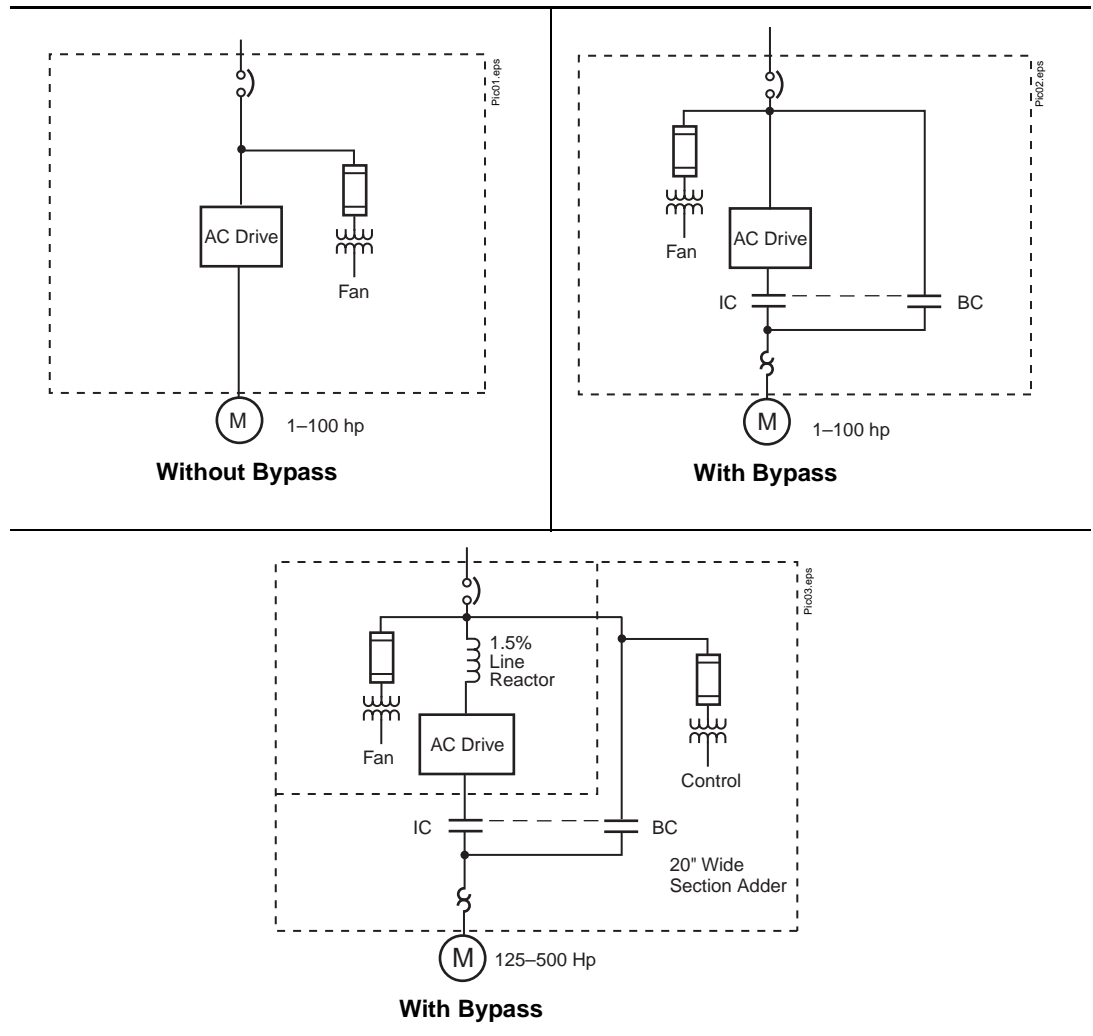
⑩ Miscellaneous Options	
Code	Feature

⑩ Miscellaneous Options	
A10	Line Reactor nominal 5% impedance
B10	Line Contactor
C10	3–15 psi Transducer
D10	Omit Keypad
E10	Smoke Purge Relay
F10	(Reserved)
G10	cUL Listing
H10	Seismic Certification (Floor-mounted Enclosures)
J10	0–10 Vdc Auto Speed Reference
K10	Additional N.O. Auxiliary Drive Run Contact
L10	Additional N.C. Auxiliary Drive Fault Contact
M10	1 N.O. Auxiliary Bypass Run Contact
N10	(Reserved)
O10	1 N.O. Auxiliary Auto Mode Contact
P10	AFC Fault Reset
Q10	Push-To-Test Pilot Lights
R10	Auto Transfer to Bypass
S10	Motor Elapsed Time Meter
T10	Emergency Stop
U10	Motor Space Heater Sequencing
V10	Seal Water Solenoid
W10	Check Valve Sequencing
X10	(Reserved)
Y10	(Reserved)
Z10	24 Vdc Power Supply
110	Additional Control Power VA
210	(Reserved)
310	Order Engineered Special (internal use only)
410	RFI Suppressor
510	Permanent Wire Marker Sleeves
610	I.D. Engraved Nameplates
710	Harmonic Filter Provisions
810	(Reserved)
910	Barriered Bypass Enclosure

Class 8839 58M Enclosed AC Drives Power Circuit Descriptions

POWER CIRCUITS

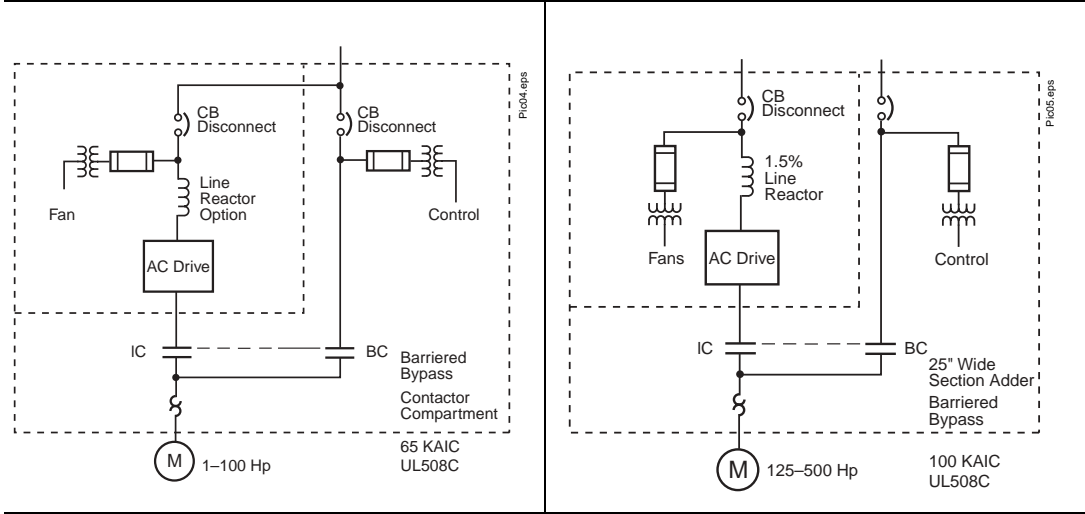
There are two primary power circuit configurations, drive controller only or drive with bypass. Power circuit configurations can be modified with a selection of options such as Barriercd Bypass, Input Line Contactors, selection of Line Reactors, or provisions for Harmonic Filters.



Class 8839 58M Enclosed AC Drives Power Circuit Descriptions

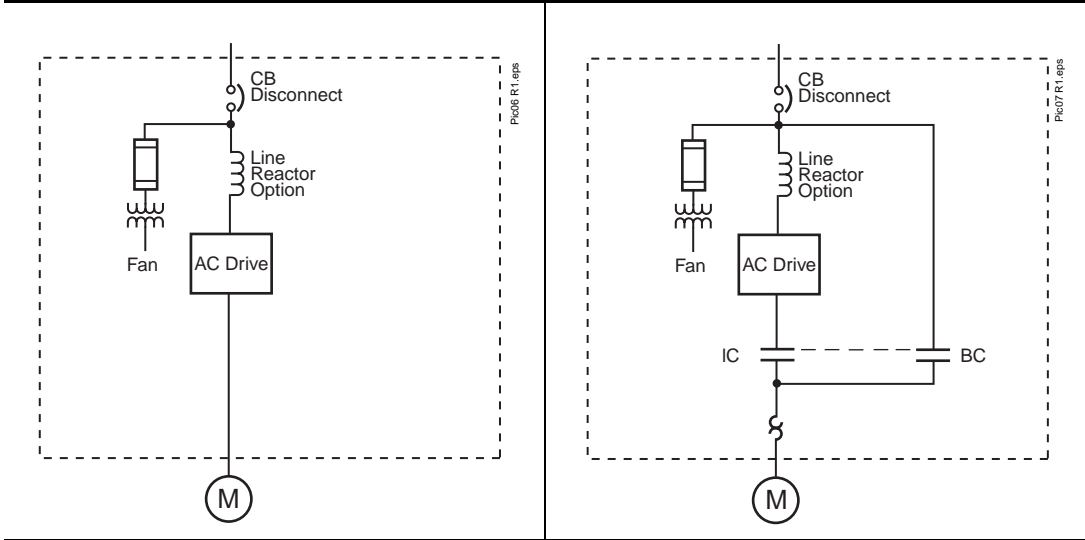
Barriered Bypass

Bypass configurations use isolation/bypass contactors to provide emergency full speed operation with Class 20 overloads. When Barriered Bypass (option 910) is selected, configurations with bypass are supplied with dual disconnects and compartmentalized construction for proper circuit isolation when performing maintenance.



Line Reactor Options

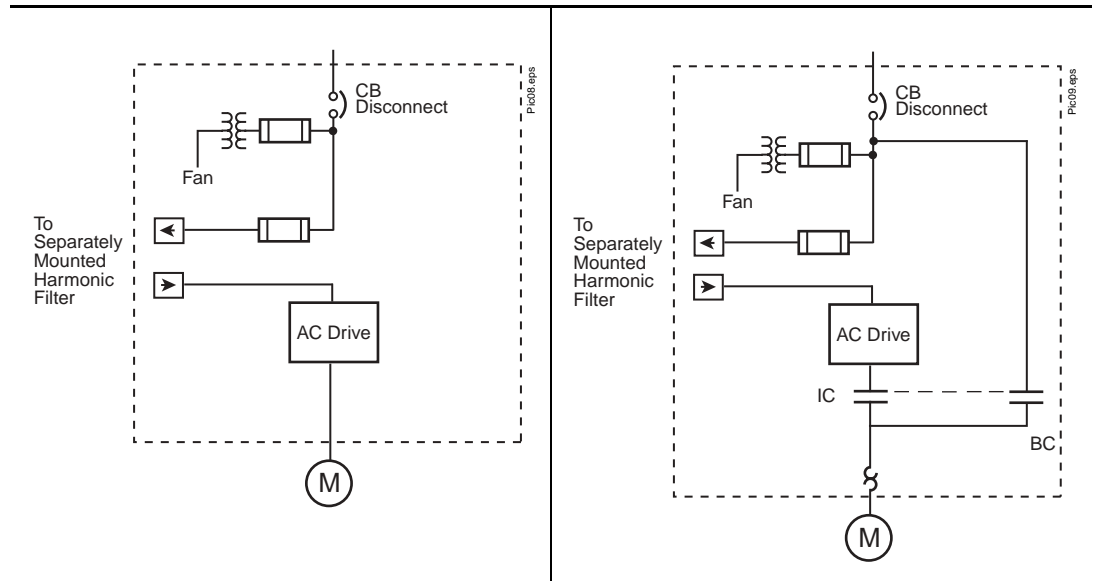
Line reactor options are wired ahead of the drive controller and do not affect bypass operation when supplied.



Class 8839 58M Enclosed AC Drives Power Circuit Descriptions

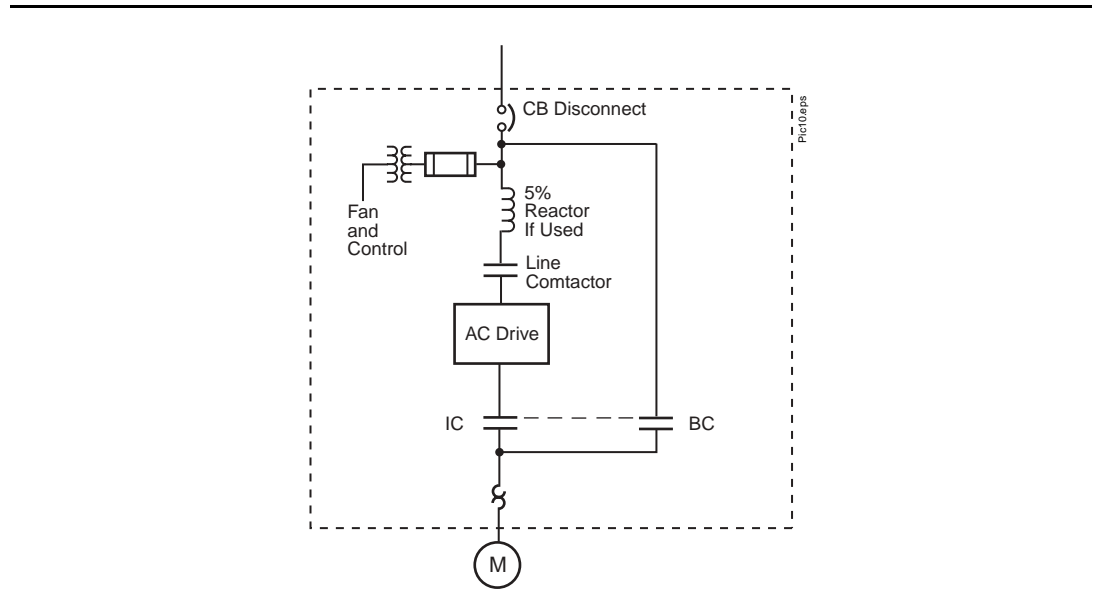
Harmonic Filter Options

The Harmonic Filter option (option 710) provides integrated short circuit protection for separately mounted harmonic filters by coordinating the Class 8839 58M Enclosed drive's circuit breaker as a common disconnect for both filters and drive. Branch circuit protection is also provided with fuses according to the National Electrical Code. This option is wired so that it does not affect bypass operation when supplied.



Line Contactor Options

The Line Contactor option (option B10) offers a three-contactor isolation/bypass strategy when Barrired Bypass is not required but when drive isolation while operating on bypass is desired.



OPERATOR CONTROL DEVICE OPTIONS

These door-mounted operator controls provide digital and analog inputs for commanding drive speed and start/stop functions. The digital and analog input terminals are active only when the keypad is programmed for the Terminal Mode of operation.

Mod A07	<p>Hand-Off-Auto selector switch with manual speed potentiometer</p> <p>Provides a door-mounted three-position selector switch and manual speed potentiometer. The Hand-Off-Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Auto position, the motor may be started and stopped by a user-supplied remote contact. The speed may be adjusted by a 4–20 mAdc signal to analog input reference AI2 or with the door-mounted manual speed potentiometer. The Off position stops the motor and is also used to reset drive controller faults.</p>
Mod B07	<p>Hand-Off-Auto selector switch Start/Stop push buttons and manual speed potentiometer</p> <p>Provides a door-mounted three-position selector switch and manual speed potentiometer. The Hand-Off-Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Auto position, the motor may be started and stopped by a user-supplied remote contact. The speed may be adjusted by a 4–20 mAdc signal to analog input reference AI2 or with the door-mounted manual speed potentiometer. In the Hand position, Start/Stop pushbuttons are used to start and stop the motor using a three-wire control strategy. The Off position stops the motor and is also used to reset drive controller faults.</p>
Mod C07	<p>Start/Stop push buttons with manual speed potentiometer</p> <p>Provides Start/Stop pushbuttons to start and stop the motor using a three-wire control strategy. The speed is adjusted by a door-mounted manual speed potentiometer. The drive disconnect is used to reset drive controller faults unless the Fault Reset (option P10) is ordered.</p>
Mod D07	<p>Start/Stop push buttons, Forward-Reverse selector switch with manual speed potentiometer</p> <p>Provides Start/Stop pushbuttons to start and stop the motor using a three-wire control strategy. The speed is adjusted by a door-mounted manual speed potentiometer. Motor direction is controlled with a forward-reverse selector switch. The drive disconnect is used to reset drive controller faults unless the Fault Reset option (option P10) is ordered.</p>
Mod E07	<p>Hand-Off-Auto selector, Local-Remote selector switch with manual speed potentiometer</p> <p>Provides a door-mounted three-position selector switch and manual speed potentiometer. The Hand-Off-Auto selector switch is used to select between the AI1 and AI2 analog inputs. In the Auto position, the motor may be started and stopped by a user-supplied remote contact. The speed may be adjusted by a 4–20 mAdc signal to analog input reference AI2 or with the door-mounted manual speed potentiometer. The Off position stops the motor and is also used to reset drive controller faults.</p>
Mod F07	<p>Communication-Auto-Off-Hand selector switch with manual speed potentiometer</p> <p>Provides a door-mounted four-position selector switch and manual speed potentiometer door. The Communication-Auto-Off-Hand selector switch is used to select between the AI1 and AI2 analog inputs. In the Auto position, the motor may be started and stopped by a user-supplied remote contact. The speed may be adjusted by a 4–20 mAdc signal to analog input reference AI2 or with the door-mounted manual speed potentiometer. The Off position stops the motor and is also used to reset drive controller faults. In Communication position, control is by serial communication to a communication card.</p>

Class 8839 58M Enclosed AC Drives Standard Modifications

PILOT LIGHT OPTIONS

Pilot lights are ordered in light groups and door-mounted. Pilot light groups are selected with compatible control options. Pilot lights are 22 mm using long-life LEDs.

Mod A08	Power On, Fault, Run, Auto Pilot Lights Pilot light cluster option #1
Mod B08	Power On, Fault, Run, Bypass Pilot Lights Pilot light cluster option #2
Mod C08	Power On, Fault, Run Pilot Lights Pilot light cluster option #3
Mod D08	Power On, Fault, Forward, Reverse Pilot Lights Pilot light cluster option #4
Mod E08	Power On, Fault, Run, Hand, Auto Pilot Lights Pilot light cluster option #5
Mod F08	Power On, Fault, Run, Communication Pilot Lights Pilot light cluster option #6

COMMUNICATION AND OPTION CARDS

Mod A09	MODBUS Plus Communication Card Provides factory-installed plug-in MODBUS Plus card (VW3A58302U) and 990NAD219XX MODBUS Plus cable with connector.
Mod B09	MODBUS/Unitelway Communication Card Provides factory-installed plug-in MODBUS card (VW3A58303U) and separate user termination to D-shell interface device.
Mod C09	Johnson Controls METASYS N2 Communication Card Provides factory-installed plug-in METASYS N2 card (VW3A58354U) and separate user termination to D-shell interface device.
Mod D09	Ethernet MODBUS TCP/IP Communication Card Provides factory-installed plug-in Ethernet card (VW3A58301U) with RJ45 connector port.
Mod E09	LonWorks to MODBUS Communication Gateway Provides factory-installed LonWorks to MODBUS module (VW3A58312PU), 24Vdc power supply (option Z10) and plug-in MODBUS card (VW3A58303U).
Mod F09	DeviceNet Communication Provides factory-installed plug-in DeviceNet card (VW3A58309U) wired to user terminal block TB5.
Mod H09	Analog Option Card Provides factory-installed analog I/O card (VW3A58201U) wired to user terminal block TB3. Provides 1 additional analog output, 2 additional logic inputs, 1 additional logic output, and 1 differential analog input.

Class 8839 58M Enclosed AC Drives Standard Modifications

MISCELLANEOUS OPTIONS

Mod A10	Line Reactor (5%) Line reactors (5% effective impedance) are provided inside the drive enclosure. Line reactors are wired in the power converter circuit and do not affect operation of full speed bypass if provided.
Mod B10	Line Contactor Provides a line contactor option for bypass power circuits. The line contactor is opened when the drive controller is not commanded to run or is in the bypass mode of operation. This option is not available with Barrired Bypass (option 910)
Mod C10	3–15 psi Transducer Allows the drive controller to follow a user supplied 3–15 psi input.
Mod D10	Omit Keypad The keypad is not supplied. The user must buy a keypad as a separate device to program the drive controller.
Mod E10	Smoke Purge Provides a smoke purge operating mode controlled by a user-supplied 120 Vac signal wired to terminal block TB1. Smoke purge operation is full speed bypass (when provided) or high speed in the drive controller. This operation is designed to run the motor from any operator control setting except emergency stop or open safety interlocks
Mod G10	CSA / cUL Certification Provides Canadian cUL or CSA certification when required by local code requirements.
Mod H10	Seismic Certification (Floor Mounted Enclosures) Provides a floor-mounted enclosure certified to seismic rating AC156 harmonized with NFPA 5000 and IBC 2000 standards.
Mod J10	0–10 V Auto Speed Reference Provides a controller interface for 0–10 Vdc user-supplied auto speed reference signal to the AI2 input using a 0–10V/4–20mA converter (part number 31158-297-50). Source impedance: Z=40kΩ.
Mod K10	1 Additional N.O. Auxiliary Drive Run Contact Provides 1 additional N.O. contact for drive run indication wired to TB1.
Mod L10	1 Additional N.C. Auxiliary Drive Fault Contact Provides 1 additional N.C. contact for drive fault indication wired to TB1.
Mod M10	1 N.O. Auxiliary Bypass Run Contact Provides 1 additional N.O. contact for bypass run indication wired to TB1.
Mod O10	1 N.O. Auxiliary Auto Mode Contact Provides 1 additional N.O. contact for auto mode indication wired to TB1.
Mod P10	Drive Fault Reset Pushbutton Provides a factory-installed door-mounted push button to reset the controller fault when Hand-Off-Auto in not used.
Mod Q10	Push-To-Test Pilot Lights Provides push-to-test function on all pilot lights except Power On.
Mod R10	Auto Transfer to Bypass Provides an automatic transfer (time adjustable 0.1–10 s) to bypass in the event that the drive controller faults. A selector switch is provided inside the enclosure to enable or disable this function. Longer transfer time requirements are available by replaceable plug-in adjustable timer.
Mod S10	Motor Elapsed Time Meter Provides an elapsed time meter to record the motor run time. Runs whenever the motor is running.
Mod T10	Emergency Stop Mushroom Head Pushbutton Provides a door-mounted maintained off emergency stop red mushroom pushbutton with turn-to-reset feature.

Class 8839 58M Enclosed AC Drives Standard Modifications

Mod U10	Motor Space Heater Sequencing Circuit Provides 50 VA/120 V to terminal block TB1 for motor space heater whenever the motor is not running.
Mod V10	Seal Water Solenoid Provides 50 VA/120 V to terminal block TB1 for seal water solenoid whenever the motor is running.
Mod W10	Check Valve Sequencing Circuit (Gravity Type) Provides an automatic shutdown of the drive controller when the user supplied N.C. contact from the check valve limit switch does not open within 5 seconds after the motor starts. The user limit switch contact connects to terminal block TB1. Circuit provides reset function with illuminated pushbutton.
Mod Z10	24 VDC Power Supply Provides 24 Vdc, 300 mA power supply at terminal block TB2.
Mod 110	Additional Control Power VA Transformer Capacity Provides a 50 VA larger control transformer for use with 120 Vac connected to terminal block TB1.
Mod 310	Order contains E-Mods or Special Modifications For internal use only.
Mod 410	RFI Suppressors Provides radio frequency interference suppression with ferrites on the power leads to the drive controller input.
Mod 510	Permanent Wire Markers (Sleeve Type) Provides permanent wire sleeve type markers on control wiring. Note: Permanent wire markings are provided as standard.
Mod 610	I.D. Engraved Enclosure Nameplates Provides an engraved laminated nameplate attached to the front door of the enclosure (engraved per user request at time of order)
Mod 710	Harmonic Filter Provisions Provides fused output terminals with return terminals for connection of an externally mounted harmonic filter. (Class J fuses provided)
Mod 910	Barriered Bypass Enclosure Provides a floor-mounted, two door, two compartment enclosure with two disconnects (one for the drive controller and one for the bypass).

Class 8839 58M Enclosed AC Drives Factory Engineered Modifications

The standard enclosure dimensions of the Class 8839 58M Enclosed drives may not apply to orders containing E-Mods. Orders containing E-Mods may carry a UL508A label in lieu of a UL508C label.

CONTROL OPTIONS

Form modifications in the E200 series cover control circuit engineered features for the Class 8839 58M Enclosed drive controller.

Mod E200	Menu-based message display center Large full text screen display and setup of drive parameters. Provides meter display functions, I/O map, and fault message display Note: The message display center replaces the standard keypad display.
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Rules: Requires selection of 24 V power supply option Z10.

Mod	Door-mounted meters
E201	Analog percent speed meter scaled 0 to 120% base speed
E202	Analog percent current scaled 0 to 100% of rated output current
E203	Digital ammeter (amperes) scaled 0 to 2 times rated output amperes
E204	Digital speed meter (frequency) scaled 0 to 72 Hz output frequency
E205	Digital percent speed meter scaled 0 to 120% base speed
E206	Digital percent current scaled 0 to 100% of rated output current

Rules: Limited to one meter selection unless Analog input option card (H09) is selected. If H09 is selected, one additional meter can be selected.

Mod E211	Door-mounted Modbus/PDA port Provides one 9-pin D shell port for connection to a PDA or a PC with PowerSuite software. A two-position selector switch is used to select between PDA port operation and keypad operation.
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Mod E212	Auxiliary drive run contacts Provides three additional Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks for customer use. Note: One Form 'C' contact for drive run is supplied as standard.
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Rules: Available only if one additional N.O. Drive Run Contact standard option K10 is selected.

Mod E213	Auxiliary bypass run contacts Provides three Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks for customer use. Note: One N.O. contact for bypass run is supplied as standard when bypass is provided.
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Rules: Available only if one additional N.O. Aux. Bypass Run Contact standard option M10 is selected.

Mod E214	Auxiliary drive fail contacts Provides three Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks for customer use. Note: One Form 'C' contact for drive fault indication is supplied as standard.
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Rules: Available only if one additional N.O. Drive Fault Contact standard option L10 is selected.

Mod E215	Auxiliary auto mode contacts Provides three Form 'C' contacts rated 5 A @ 120 Vac wired to terminal blocks for customer use. Note: One N.O. contact for auto mode indication is supplied as standard when auto mode operation is provided.
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Rules: Available only if one N.O. Auto Mode Contact standard option O10 is selected.

Mod E216	Adjustable restart delay timer Provides an adjustable On Time Delay Relay for power up restart function, mounted and wired for AFC mode (hand or auto) mode and/or in the bypass mode (hand/auto).
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Rules: Available on all configurations.

Mod E217	Motor space heater Provides control circuit contacts, 120 V, 150–500 VA supply and fusing wired to terminals for customer use. Note: Specify VA requirements at time of order entry in the 'Engineering Notes' field within Q2C.
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Rules: Available on all configurations.

Class 8839 58M Enclosed AC Drives Factory Engineered Modifications

Mod E218	<p>Signal loss follower alarm relay</p> <p>Provides one Form 'C' contact rated 5 A @ 120 Vac wired to terminal blocks for customer use. Intended for 4–20 mAdc control loop applications where upon the loss of input signal it is desired to retain the output signal at the last input signal level. The relay provides an alarm relay contact for signal loss alert. Note: Requires use of logic output LO1.</p>
Rules: Available on all configurations.	
Mod E219	<p>Inhibit/shutdown sequence (timed operation)</p> <p>Provides a relay circuit operating in the fail safe mode where a remote initiating contact opens the relay, deenergizes, and after a specified time shuts the drive controller down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).</p>
Rules: Available on all configurations.	
Mod E220	<p>Check valve sequence (motorized type)</p> <p>Provides relay circuitry sequenced from a check valve limit switch. A valve closed position limit switch will energize relays that will initiate a remote valve operating solenoid limited to 50 VA and give a run permissive to the drive controller in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto). A valve closed position limit switch will de-energize a timer relay such that if this relay is not de-energized within a specified time period, the drive controller will shut down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).</p>
Rules: Available on all configurations.	
Mod E221	<p>Seal water solenoid - with pressure switch feedback</p> <p>Provides a relay, which will energize a remote seal water solenoid limited to 50 VA during drive controller operation. Additionally, the remote initiating contact will open the relay, deenergize, and after a specified time shut the drive controller down in the AFC mode (hand or auto) and/or in the bypass mode (hand or auto).</p>
Rules: Available on all configurations.	
Mod E222	<p>Moisture detection relay circuit (without relay)</p> <p>Provides 24 V or 120 V control power to a customer-supplied moisture detection relay device, either electronic or electro-mechanical. Factory provides pre-wired socket or mounting space only. Note: Customer supplies relay. Details concerning type must also be provided at time of order entry in the 'Engineering Notes' field within Q2C.</p>
Rules: Available on all configurations.	
Mod E223	<p>Moisture detection relay circuit (with relay)</p> <p>Provides 24 V or 120 V control power to a customer-supplied moisture detection relay device, either electronic or electro-mechanical. The customer-supplied moisture detection relay is mounted and wired by the factory. Note: Details concerning type must be provided at time of order entry in the 'Engineering Notes' field within Q2C.</p>
Rules: Available on all configurations.	
Mod E224	<p>Substitute Type K operators</p> <p>Provides Class 9001 Type K 30 mm heavy duty multifunction operators in place of standard Telemecanique 22 mm pilot devices.</p>
Rules: Available on all configurations.	
Mod E225	<p>Spare control relays</p> <p>Provides unwired control relays mounted for customer use.</p>
Rules: Available on all configurations.	
Mod E226	<p>Substitute pilot light lens color(s)</p> <p>Provides the flexibility to configure lens cap colors to contract equipment designations. Note: specify lens cap colors desired at time of order entry in 'Engineering Notes' field within Q2C.</p>
Rules: Available on all configurations.	
Mod E227	<p>Blown fuse indicators on control fuses</p> <p>Provides blown circuit fuse indicators on control circuit fuses in lieu of standard fuses.</p>
Rules: Available on all configurations.	
Mod E228	<p>Motor over temperature logic input</p> <p>Provides dedicated terminals using an external motor over temperature input (N.C. contact) factory wired and programmed.</p>
Rules: Available on all configurations.	

Class 8839 58M Enclosed AC Drives Factory Engineered Modifications

Mod E229 Expand	<p>RTD inputs (motor protection alarm)</p> <p>Provides capability for accepting RTD inputs using an RTD limit alarm, factory mounted and wired. Limited to three RTD inputs. Note: Specify RTD values at time of order entry in 'Engineering Notes' field within Q2C</p>
Rules: Available on all configurations.	
Mod E230	<p>Motor management relay</p> <p>Provides motor protection and metering functions using the GE/Multilin motor management relay. This relay provides protection for motor and load conditions: overload, differential, stator temperature, high inertia loads, undercurrent, underpower, jam and bearing overtemperature. The motor management relay is factory mounted and wired. Includes PTs and CTs.</p>
Rules: Available on units rated 125 hp and higher.	
Mod E231	<p>PowerLogic® power meter display</p> <p>Provides a Class 3020 PM-650 Power module true rms meter display with basic instrumentation, demand, THD, date/ time stamping, neutral current, min/max, alarms, event and data storage factory mounted and wired.</p>
Rules: Available on all configurations.	
Mod E232	<p>CM-3250 PowerLogic circuit monitor</p> <p>Provides a Class 3020 CM-3250 circuit monitor display with instrumentation, 0.2% accuracy, data logging and waveform capture, factory mounted and wired. Includes PTs and CTs.</p>
Rules: Available on all configurations.	
Mod E233	<p>CM-3350 PowerLogic circuit monitor</p> <p>Provides a Class 3020 CM-3350 circuit monitor display with instrumentation, 0.2% accuracy, data logging and waveform capture, factory mounted and wired. Includes PTs and CTs.</p>
Rules: Available on all configurations.	
Mod E234	<p>Spare terminal blocks (unwired)</p> <p>Provides ten spare terminal blocks 'unwired' for customer use using the Class 9080 Type G series terminals.</p>
Rules: Available on all configurations.	
Mod E235	<p>Damper Control Circuit</p> <p>Provides a damper control circuit to coordinate starting of the drive controller or the bypass with the position of the damper. Requires connection to customer damper limit switch.</p>
Rules: Available on all configurations.	
Mod E236	<p>Emergency power off push-button</p> <p>Provides a shunt trip modified molded case switch or circuit breaker where a push-pull maintained mushroom head push-button energizes the shunt trip coil and instantaneously opens to shut down power supplied to the drive controller in the AFC mode and/or bypass mode, coasting to an uncontrolled stop.</p>
Rules: Available on all configurations.	

Class 8839 58M Enclosed AC Drives Factory Engineered Modifications

ENCLOSURE & MISCELLANEOUS MODIFICATIONS

Form modifications in the E300 series cover enclosure and miscellaneous enclosed features for the Class 8839 58M Enclosed drive controller.

Mod E301	ANSI #61 Enclosure paint Provides option to configure enclosure paint to industry standard ANSI#61 light gray paint in lieu of ANSI #49 dark gray
Rules: Available on all configurations.	
Mod E302	Free standing enclosure (1– 20 HP CT/1– 25 HP VT 460 VAC) Converts all standard wall mounted enclosure configurations to a floor-mounted 90 in. high enclosure.
Rules: Available on configurations up to 20 hp CT or 25 hp VT.	
Mod E303	Oversized enclosure (1– 50 HP CT/1– 60 HP VT 460 VAC) Converts all standard wall and floor-mounted enclosures up one enclosure size.
Rules: Available on configurations up to 50 hp CT/60 hp VT.	
Mod E304	Barriered enclosure expansion Uses Barriered enclosure for non-bypass drives controllers. Bypass space is configured with circuit breaker disconnect and handle only.
Rules: Available on configurations up to 75 hp Constant Torque or 100 hp Variable Torque.	

POWER OPTIONS

Form modifications in the E400 series cover engineered power circuit configurations for the Class 8839 58M Enclosed drive controller.

Mod E401	Dynamic braking resistors (Top mounted) Provides dynamic braking resistor top mounted on the enclosure. Resistors are 10% duty cycle rated. Overload protection for externally mounted dynamic braking resistor is mounted inside the drive controller enclosure. Note: Drives rated 125–500 hp @ 460 V do not provide internal dynamic braking transistors. Consult factory
Mod E402	Top mounted motor protecting filter Provides a factory mounted and wired dv/dt filter on the drive output for long motor lead lengths considerations in excess of our published guidelines, up to 1000 feet.
Mod E403	NEMA rated contactors Provides NEMA rated contactors for isolation and bypass configuration in lieu of the IEC rated contactors. Note: Devices rated 250–400 hp @ 460 V use NEMA rated contactors as standard.
Rules: Available for Barriered Bypass configuration only	
Mod E404	380V/50Hz system configuration Provides device modifications to control power transformer, power contactors (when provided) and firmware configuration to 380 V/50 Hz utilization voltage and alters nameplate rating to reflect "KW" in lieu of hp ratings. Note: CE Marking not available
Rules: Available on all configurations.	
Mod E405	Transient Voltage Surge Suppressor Provides supplementary surge protection using a Class 1310 TVSS XF Series Transient Voltage Surge Suppressor hard-wired and factory mounted.
Rules: Available on all configurations.	

Class 8839 58M Enclosed AC Drives Factory Engineered Modifications

Mod E406	<p>Dual motor overloads and branch short circuit protection</p> <p>Provides short circuit and overload protection for two motors connected to the output of the drive controller. Includes overload modules for each motor. Note: The sum of the total connected motors must not exceed the drive controllers full load ampere rating. Specify motor FLA values at time of order entry in 'Engineering Notes' field within Q2C.</p>
<p>Rules:</p> <ul style="list-style-type: none"> - Available on all configurations. 	
Mod E407	<p>Motor A or B contactor alternation scheme</p> <p>Provides a contactor interlocked for the selection of one motor for load share via a selector switch or rotation timer scheme. Note: Specify mode of operation via "Motor A-OFF-Motor B" selector switch, remote contact closure or rotation timer scheme at time of order entry in 'Engineering Notes' field within Q2C.</p>
<p>Rules:</p> <ul style="list-style-type: none"> - Available on all configurations. - Not available if option E405 is selected. 	
Mod E408	<p>SEMI F47 Power Compliance</p> <p>Provides a contactor interlocked for the selection of one motor for load share via a selector switch or rotation timer scheme.</p>
Mod E409	<p>Line contactor without bypass</p> <p>Provides a contactor interlocked for the selection of one motor for load share via a selector switch or rotation timer scheme. Note: Specify mode of operation via "Motor A-OFF-Motor B" selector switch, remote contact closure or rotation timer scheme at time of order entry in 'Engineering Notes' field within Q2C.</p>
Mod E410	<p>Soft Starter Bypass</p> <p>Provides an Altistart 48 solid state reduced voltage starter as bypass.</p>
Mod E411	<p>Reduced Voltage Auto-transformer Bypass</p> <p>Provides a Class reduced voltage auto-transformer starter as bypass.</p>
Mod E412	<p>Two High Drive Construction</p> <p>Provides two drives of the same frame size in a single floor-mounted enclosure. Each drive controller has its own disconnect and uses a Barrired enclosure design. Note: Specify Drive arrangement, top mounted drive size and bottom mounted drive size. Each drive must be priced separately. This option is limited to non-bypass construction. Two High Construction in limited to 1–75 /100 hp CT/VT</p>
<p>Rules: Limited to non-bypass drive controllers</p>	

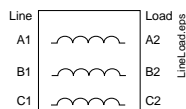
Class 8839 58M Enclosed AC Drives Three Phase Line Reactors

The Class 8839 58M Enclosed AC Drives are designed to operate from industrial power systems with normal AC line conditions without the need of additional line impedance from either an isolation transformer or a line reactor. However, when abnormal line conditions exist, additional line impedance may be required. Typically, line reactors are used to:

- Reduce the input rms current to the AC drive ratings

- Lower the available fault current on high fault distribution systems
- Limit the total harmonic voltage distortion from the AC drive at the point of common coupling to align with IEEE 519 guidelines
- Prevent AC drive nuisance tripping due to transient overvoltages from power factor correction capacitor switching

HP Rating	208/230 VAC Line Reactor Part No. (Integrated)	460 VAC Line Reactor Part No. (Integrated)	Enclosed Standard Option
1	RL-01202	RL-00802	A10
2	RL-01202	RL-00802	A10
3	RL-01202	RL-00802	A10
5	RL-01801	RL-01203	A10
7.5	RL-01801	RL-01203	A10
10	RL-03501	RL-01802	A10
15	RL-03501	RL-01802	A10
20	RL-08001	RL-01802	A10
25	RL-08001	RL-03502	A10
30	RL-10001	RL-03502	A10
40	RL-10001	RL-03502	A10
50	RL-16002	RL-08002	A10
60	–	RL-08002	A10
75	–	RL-10002	A10
100	–	RL-13002	A10
125	–	RL-16013	A10
150	–	RL-20013	A10
200	–	RL-25013	A10
250	–	RL-32013	A10
300	–	RL-40013	A10
350	–	RL-50013	A10
400	–	RL-50013	A10
450	–	RL-60013	A10
500	–	RL-60013	A10



Line Reactors:

1. The line reactors are manufactured by MTE, Inc.
2. Harmonic compensated up to 150% of nominal current ratings
3. 5% nominal reactance

4. Refer to the following publications on the subject of harmonics and benefits of drive isolation transformers:
 - **8803PD9402**–Power Systems Harmonics–Cause and Effects of AC Drives.
 - **7460HO9501**–Drive Isolation Transformers-Application, Selection and Specification Data
 - **7460PD9501**– Drive Isolation Transformers–Solutions to Power Quality

Class 8839 58M Enclosed AC Drives Motor Protecting Output Filters

Low pass filters can be used on the output of the Class 8839 58M Enclosed AC Drive to decrease the stress of resonant frequencies on the attached motor. While low pass filters are not necessary for most installations, they do provide substantial benefits in installations involving long motor leads, such as:

- 460 V or higher rated AC drives
- 1–25 hp rated units, if cable lead lengths are in excess of 75 feet
- 30–400 hp rated units, if cable lead lengths are in excess of 300 feet

- Use of a non-inverter duty rated motor(s)
- Existing general purpose motors subject to retrofit to an AC drive

The motor protecting output filters combine inductance, capacitance, and resistance to form a low pass filter. This filter will lower the dV/dt levels to prevent exciting the natural resonant wire frequency of the motor cables. Motors compliant to NEMA MG–1 Part 31 guidelines do not require the use of motor protecting output filters.

HP Rating @ 460 V	Output Filter Part No. (Separate Mounting)	Separately Mounted Engineered Option
1–2	KLCUL4A1	E402
3	KLCUL6A1	E402
5	KLCUL8A1	E402
7.5	KLCUL12A1	E402
10	KLCUL16A1	E402
15	KLCUL25A1	E402
20–25	KLCUL35A1	E402
30	KLCUL45A1	E402
40	KLCUL55A1	E402
50–60	KLCUL80A2	E402
75	KLCUL110A2	E402
100	KLCUL130A2	E402
125	KLCUL160A2	E402
150	KLCUL200A3	E402
200	KLCUL250A3	E402
250	KLCUL300A3	E402
300	KLCUL360A3	E402
350	KLCUL420A3	E402
400	KLCUL480A3	E402
450–500	KLCUL600A3	E402

Motor Protecting Output Filters:

1. Output filters are manufactured by Trans-Coil, Inc.
2. Output filters are designed for cable lead lengths ranging from 50 to 1000 feet.
3. Output filters include 1.5% nominal reactance at 480 V.
4. Output filters are enclosed in Type 1 general purpose enclosures.
5. Output filters are intended for separate mounting and wiring by user.

Class 8839 58M Enclosed AC Drives Three Phase Drive Isolation Transformers

Drive Isolation transformers are designed for maximum benefit when applied to an AC drive. In addition to the functional comparison of a line reactor, drive isolation transformers are normally used for one of the following reasons over a standard line reactor:

1. Match system voltage to drive rating.
2. Meet local or plant codes that require isolation.
3. Capable of correcting line voltage unbalance conditions commonly seen with open delta and corner grounded delta distribution systems.
4. Provides continuity of service for nuisance grounding.
5. Reduces drive induced currents in supply feeder ground and limit ground fault currents.
6. Isolate the electrical common mode noise generated in solid state controllers from the distribution system.

The Class 8839 58M Enclosed AC drives have a high fault withstand capability (up to 65,000 A or 100,000 A depending upon configuration). For these reasons, Square D does not require the use of a drive isolation transformer for isolation purposes unless the system requires one or more of the six functions listed above.

Three Phase 60 Hz Class B (IEEE 597-1983)

HP Rating	kVA	Catalog Number
1-5	7.5	7T()HDIT
7.5	11	11T()HDIT
10	15	15T()HDIT
15	20	20T()HDIT
20	27	27T()HDIT
25	34	34T()HDIT
30	40	40T()HDIT
40	51	51T()HDIT
50	63	63T()HDIT
60	75	75T()HDIT
75	93	93T()HDIT
100	118	118T()HDIT
125	145	145T()HDIT
150	175	175T()HDIT
200	220	220T()HDIT
250	275	275T()HDIT
300	330	330T()HDIT
400	440	440T()HDIT
450	550	550T()HDIT
500	550	550T()HDIT

Voltage Codes

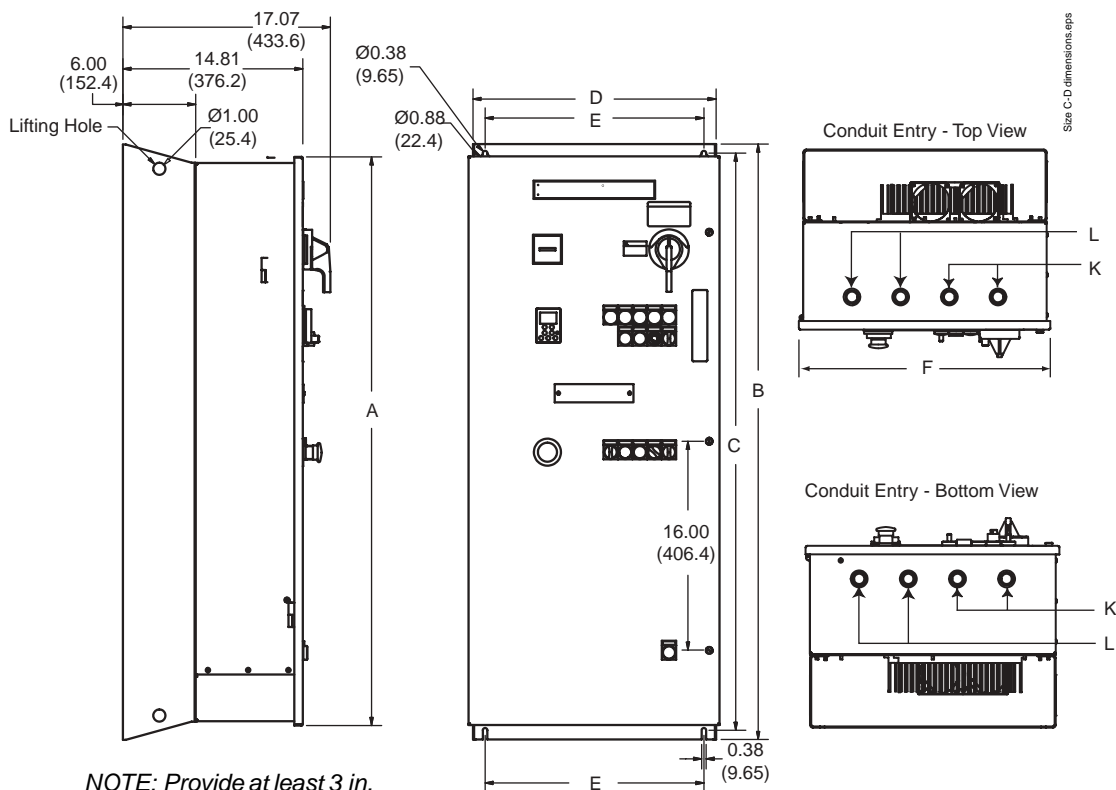
Code	Primary	Secondary
142	230 Delta	230Y/132
143	230 Delta	460Y/265
144	460 Delta	230Y/132
145	460 Delta	460Y/265
146	575 Delta	230Y/132
147	575 Delta	460Y/265

Notes:

To complete catalog number: Select the voltage required from chart. Insert the voltage code number in place of the () in the catalog number

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

.Class 8839 58M Enclosed Drives
1–20 hp CT Controllers and 1–25 hp VT Controllers @ 460 V and 1–10 hp CT/VT Controllers @ 208/230 V



NOTE: Provide at least 3 in. of mounting clearance on each side of the drive controller and at least 6 in. of mounting clearance at the top and bottom of the drive controller.

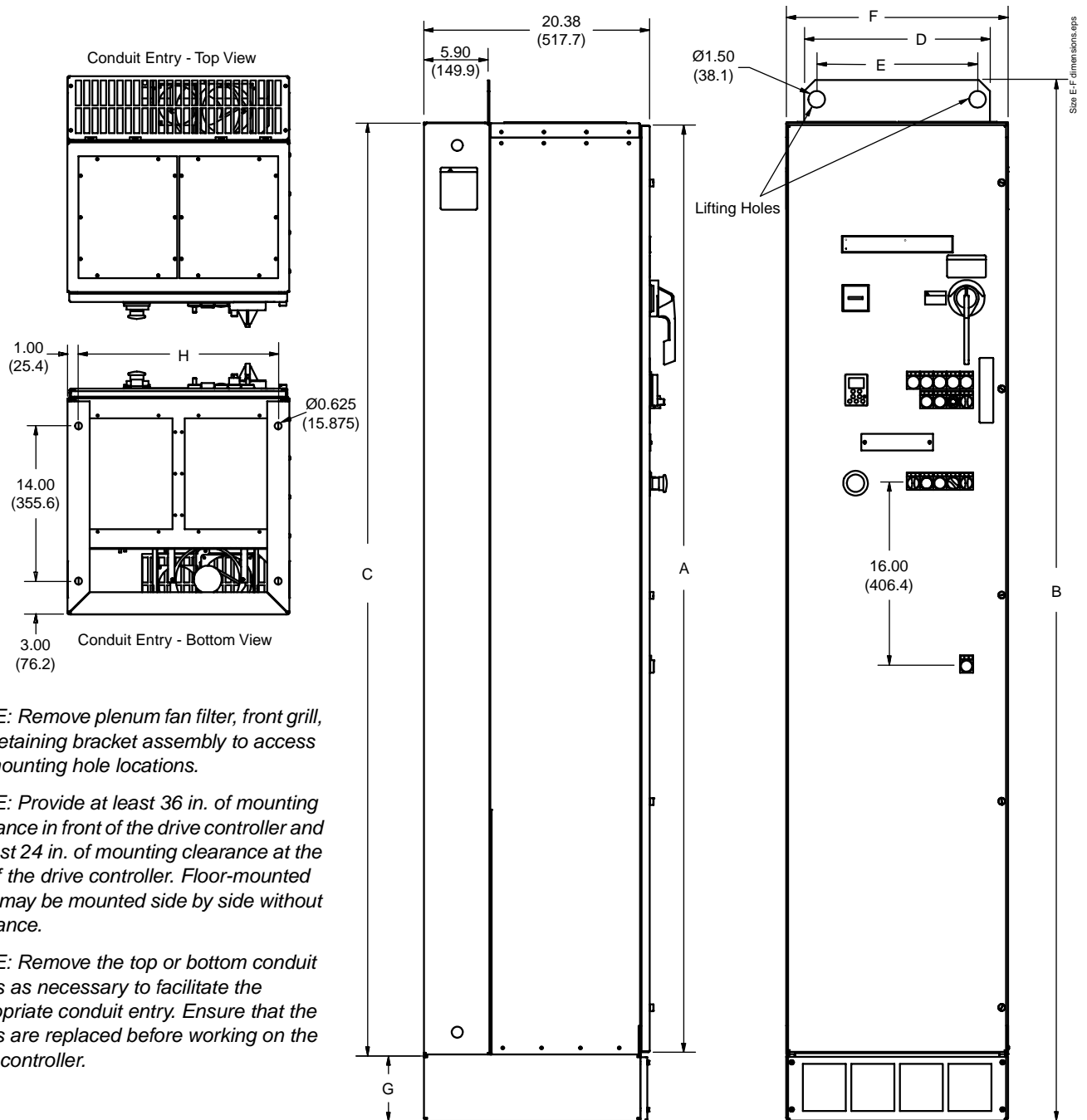
Knockout Dimensions

460 V CT	460 V VT	208/230 V CT/VT	K	L
1–20 hp	1–25 hp	1–10 hp	For 1/2 in., 3/4 in., and 1 in. conduit	For 1/2 in., 3/4 in., and 1 in. conduit

hp			Weight		Enclosure Dimensions												Enclosure Size
460 V		208/230 V	lb	kg	A		B		C		D		E		F		
CT	VT	CT/VT			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
1–20	1–25	1–5	174	78	46.80	1188	49.00	1244.6	47.83	1214.9	20	508	18.04	458.2	20.65	524.5	C
—	—	7.5–10	242	109	60.80	1544	63.00	1600.2	61.83	1570.5	25	635	23.05	585.5	25.65	651.5	D

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

Class 8839 58M Enclosed Drives: 25–75 hp CT Controllers and 30–100 hp VT Controllers @ 460 V and 15–40 hp CT Controllers and 15–50 hp VT Controllers @ 208/230 V



NOTE: Remove plenum fan filter, front grill, and retaining bracket assembly to access the mounting hole locations.

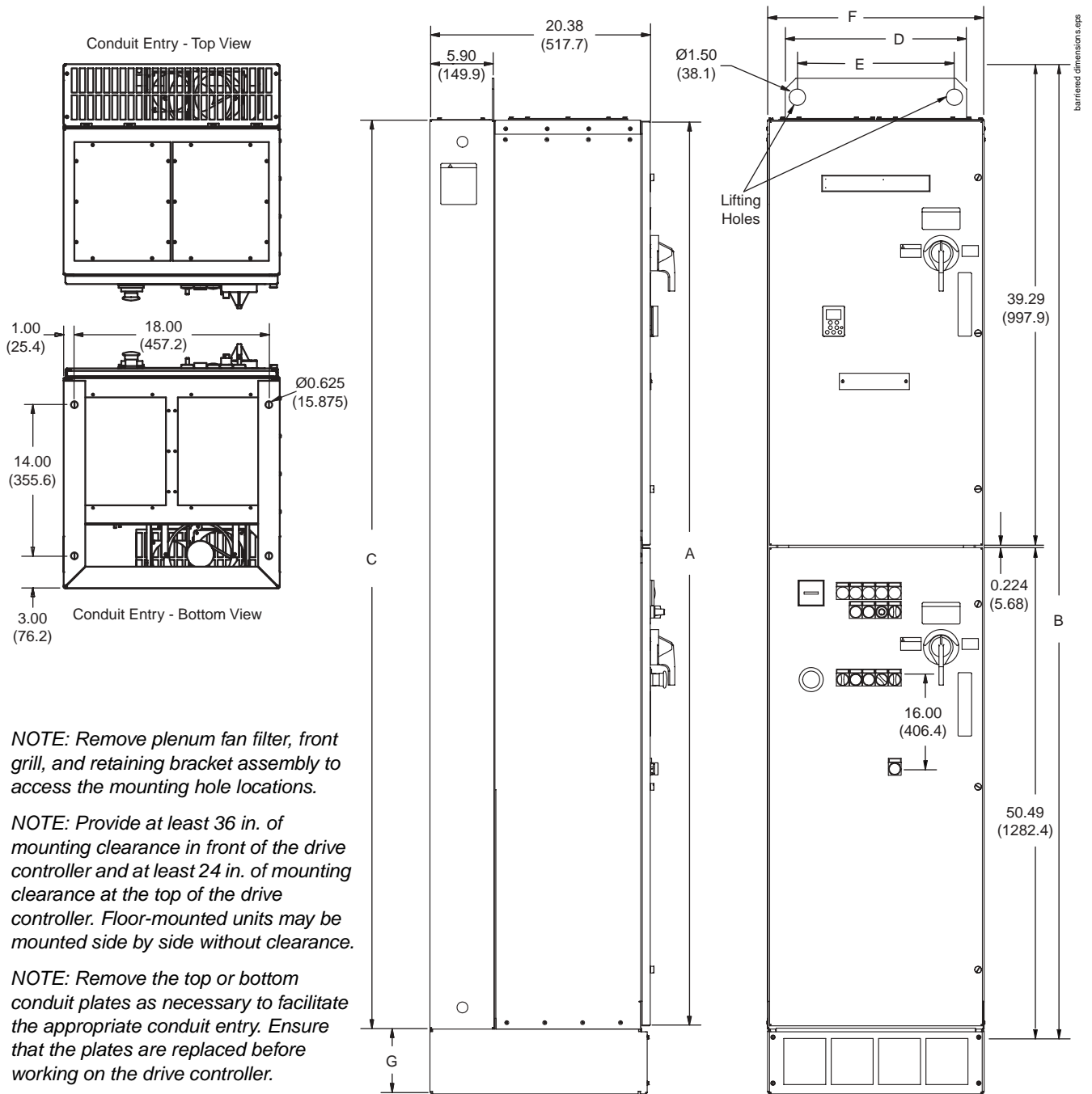
NOTE: Provide at least 36 in. of mounting clearance in front of the drive controller and at least 24 in. of mounting clearance at the top of the drive controller. Floor-mounted units may be mounted side by side without clearance.

NOTE: Remove the top or bottom conduit plates as necessary to facilitate the appropriate conduit entry. Ensure that the plates are replaced before working on the drive controller.

hp		Weight		Enclosure Dimensions																Enclosure Size		
460 V		208/230 V		lb	kg	A		B		C		D		E		F		G			H	
CT	VT	CT	VT			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm		in.	mm	in.	mm
25–40	30–50	15–20	15–25	378	171	83.38	2117.9	93.87	2384.3	84	2133.6	16.75	425.5	14.50	368.3	20	508	8.0	203.2	18	457.2	E
50–75	60–100	25–40	30–50	562	254	83.38	2117.9	93.87	2384.3	84	2133.6	23	584	19.00	482.6	25	635	8.0	203.2	23	584.2	F

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

Class 8839 58M Enclosed Drives: Barrired 1–20 hp CT Controllers and 1–25 hp VT Controllers @ 460 V and 1–10 hp CT/VT Controllers @ 208/230 V



NOTE: Remove plenum fan filter, front grill, and retaining bracket assembly to access the mounting hole locations.

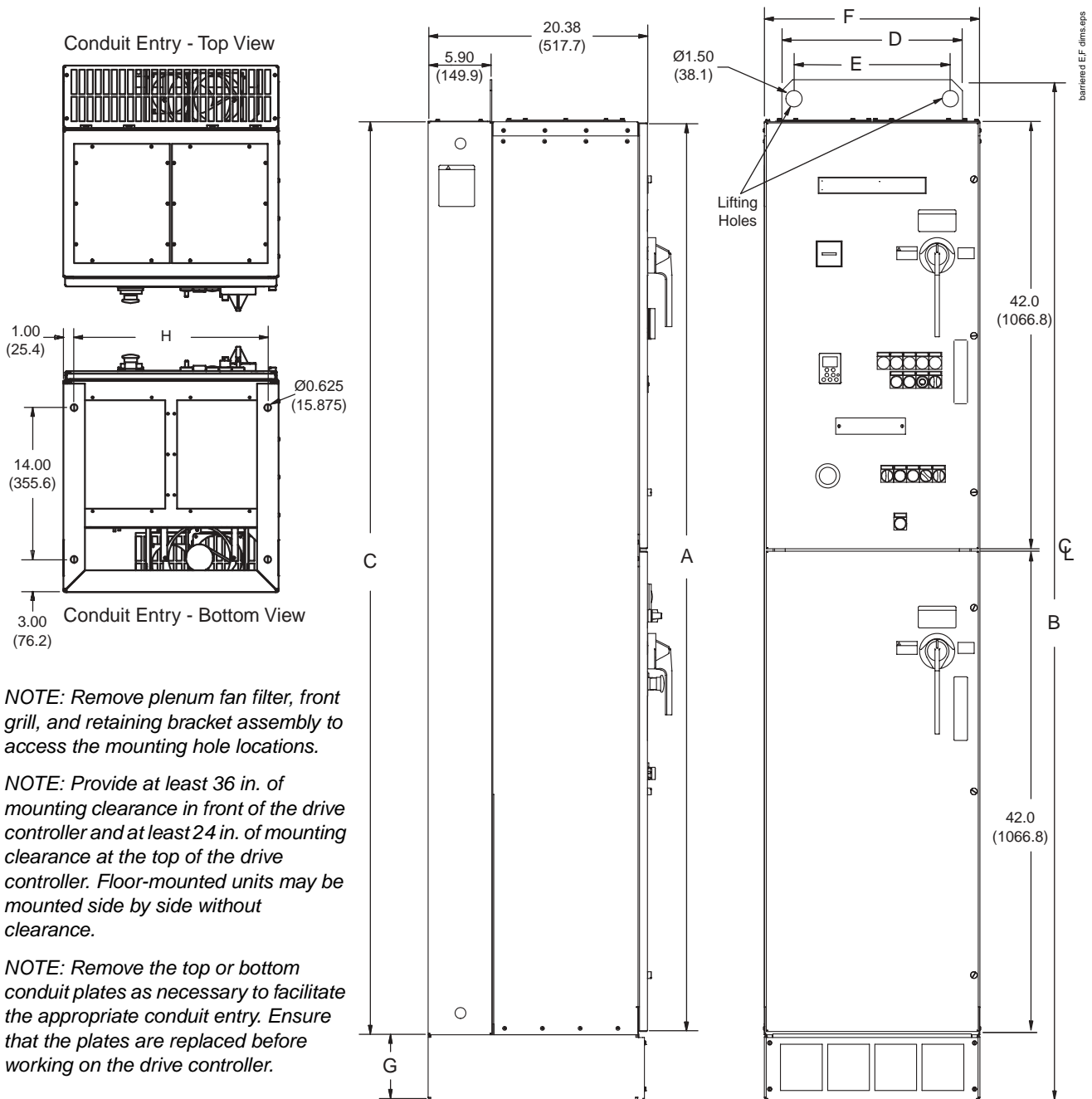
NOTE: Provide at least 36 in. of mounting clearance in front of the drive controller and at least 24 in. of mounting clearance at the top of the drive controller. Floor-mounted units may be mounted side by side without clearance.

NOTE: Remove the top or bottom conduit plates as necessary to facilitate the appropriate conduit entry. Ensure that the plates are replaced before working on the drive controller.

hp			Weight		Enclosure Dimensions														Enclosure Size
460 V		208/230 V	lb	kg	A		B		C		D		E		F		G		
CT	VT	CT/VT			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
1–20	1–25	1–10	378	171	83.38	2117.9	93.87	2384.3	84	2133.6	16.75	425.5	14.50	368.3	20	508	8.0	203.2	C/D-barrired

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

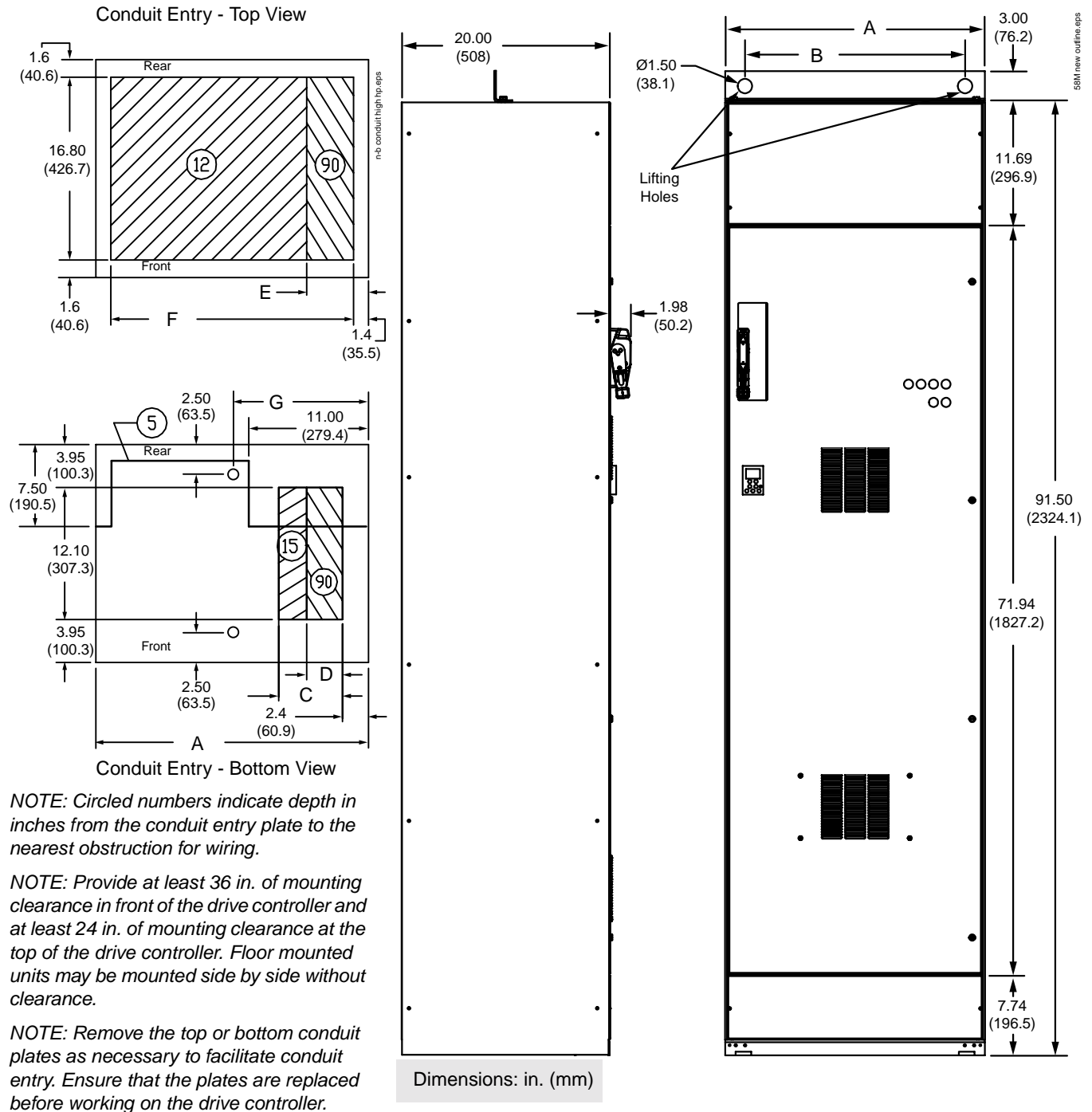
Class 8839 58M Enclosed Drives: Barrired 25–75 hp CT Controllers and 30–100 hp VT Controllers @ 460 V and 15–40/50 hp CT/VT Controllers @ 208/230 V



hp				Weight		Enclosure Dimensions																Enclosure Size
460 V		208/230 V		lb	kg	A		B		C		D		E		F		G		H		
CT	VT	CT	VT			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
25–40	30–50	15–20	15–25	398	181	83.38	2117.9	93.87	2384.3	84	2133.6	23.75	603.3	19	482.6	25	635	8.0	203.2	23	584.2	E-barrired
50–75	60–100	25–40	30–50	590	268	83.38	2117.9	93.87	2384.3	84	2133.6	25.75	654.1	24	609.6	30	762	8.0	203.2	28	711.2	F-barrired

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

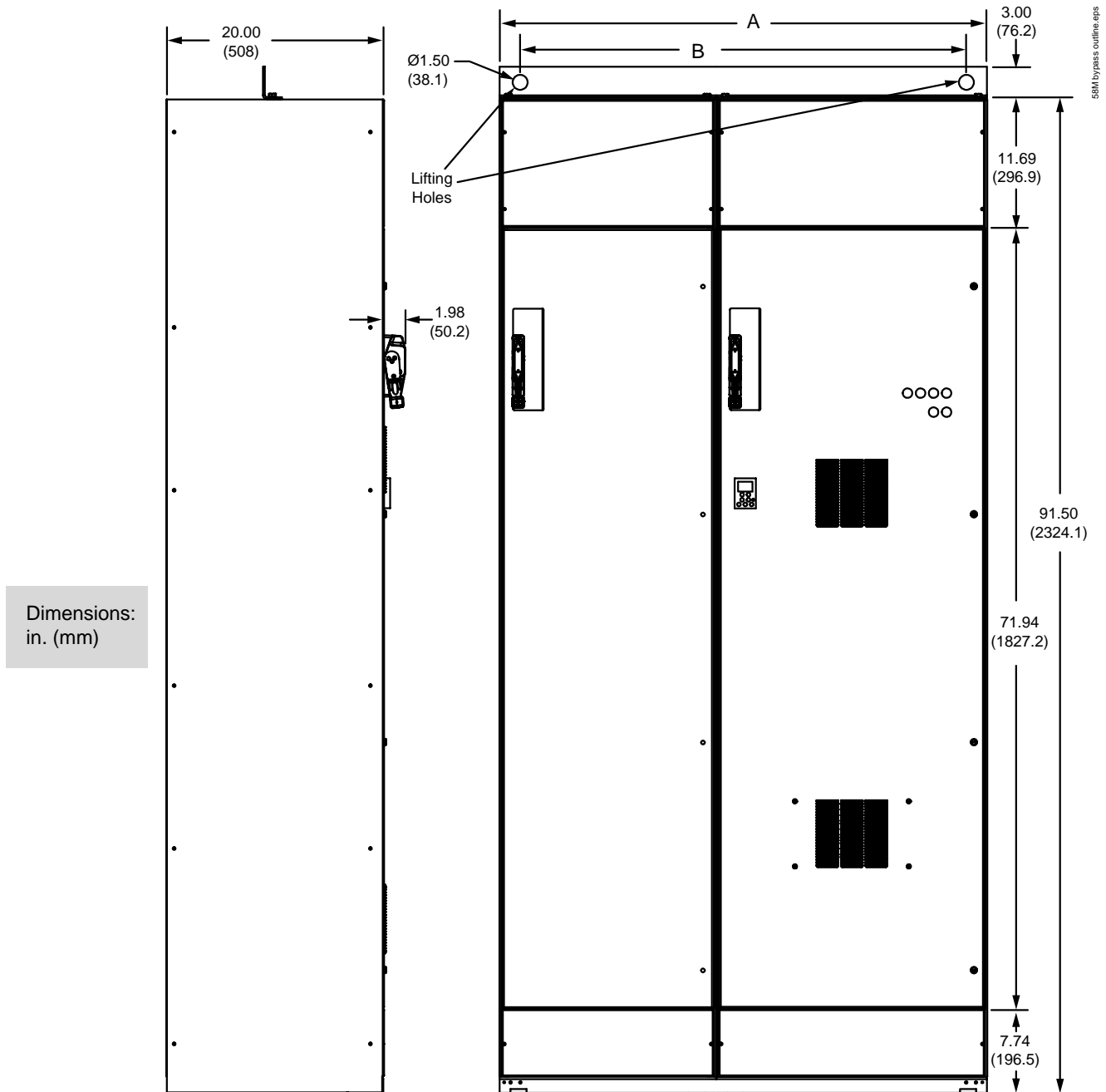
125–500 hp VT Controllers @ 460 V



hp	Weight		Enclosure Dimensions														Enclosure Size
			A		B		C		D		E		F		G		
			in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	
460 V																	
VT	lb	kg															
125	500	226.7	25	635	21.16	537.4	5.84	148.3	3.3	83.8	4.3	109.2	22.0	558.8	12.5	317.5	H
150–250	650	294.8	30	762	26.16	664.4	10.63	270.0	3.3	83.8	4.3	109.2	27.2	690.8	15.0	381.0	I
300–500	975	442.2	35	889	31.16	791.4	15.03	381.7	4.1	104.1	5.1	129.5	32.2	817.8	17.5	444.5	J

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

125–500 hp VT Controllers @ 460 V with Integrated or Barriercd Bypass (Front and Side Views)



Dimensions:
in. (mm)

hp	Weight		Enclosure Dimensions				Enclosure Size
			A		B		
460 V	lb	kg	in.	mm	in.	mm	
VT							
125	1025	464.9	45	1143	41.16	1045.4	H-integrated
150–200	1175	532.9	50	1270	46.16	1172.4	I-integrated
125	1150	521.6	50	1270	46.16	1172.4	H-barriercd
150–200	1300	589.6	55	1397	51.16	1299.4	I-barriercd

NOTE: Provide at least 36 in. of mounting clearance in front of the drive controller. Floor mounted units may be mounted side by side without clearance.

Class 8839 58M Enclosed AC Drives Dimensions and Weights for Mounting

125–500 hp VT Controllers @ 460 V with Integrated or Barriercd Bypass (Conduit Views)

hp	460 V	VT	125	150–200	125	150–200		
Weight		lb	1025	1175	1150	1300		
		kg	464.9	532.9	521.6	589.6		
Enclosure Dimensions		C		in.	5.84	10.63	5.84	10.63
				mm	148.3	270.0	148.3	270.0
		D		in.	25	30	25	30
				mm	635	762	635	762
		E		in.	22.2	27.2	22.2	27.2
				mm	563.8	690.8	563.8	690.8
		F		in.	22.5	25.0	25.0	27.5
				mm	571.5	635	635	698.5
		G		in.	12.5	15.0	12.5	12.5
				mm	317.5	381.0	317.5	317.5
		Enclosure Size			integrated		barriercd	
					H	I	H	I

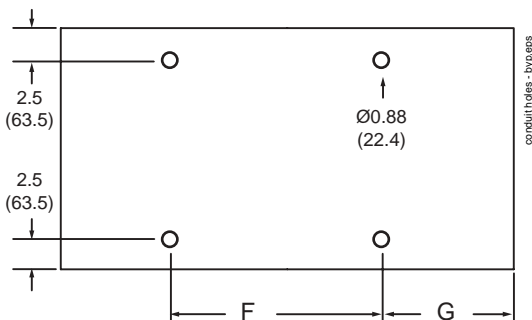
NOTE: Provide at least 24 in. of mounting clearance at the top of the drive controller.

NOTE: Remove the top or bottom conduit plates as necessary to facilitate the appropriate conduit entry. Ensure that the plates are replaced before working on the drive controller.

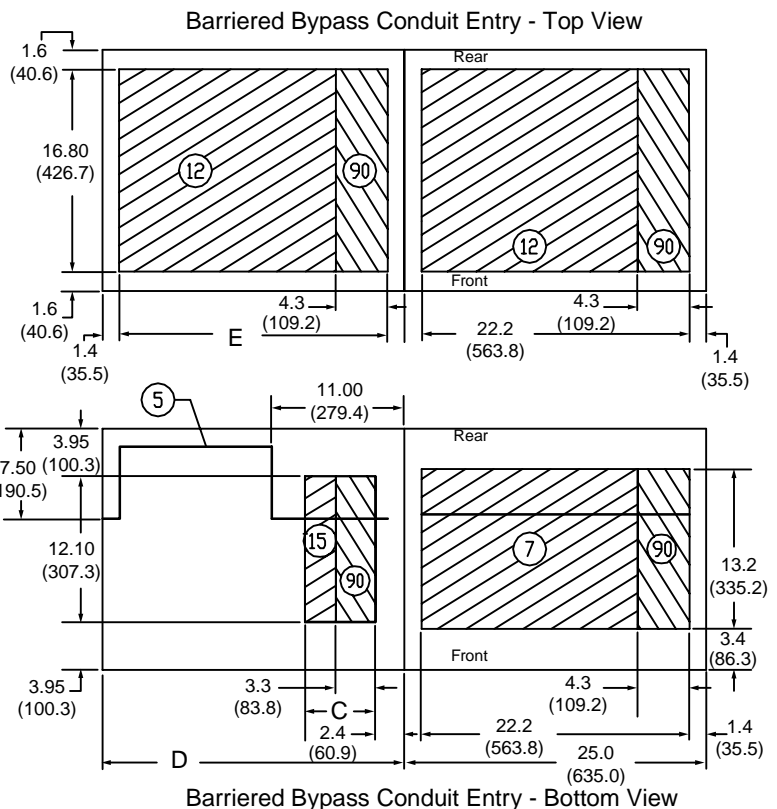
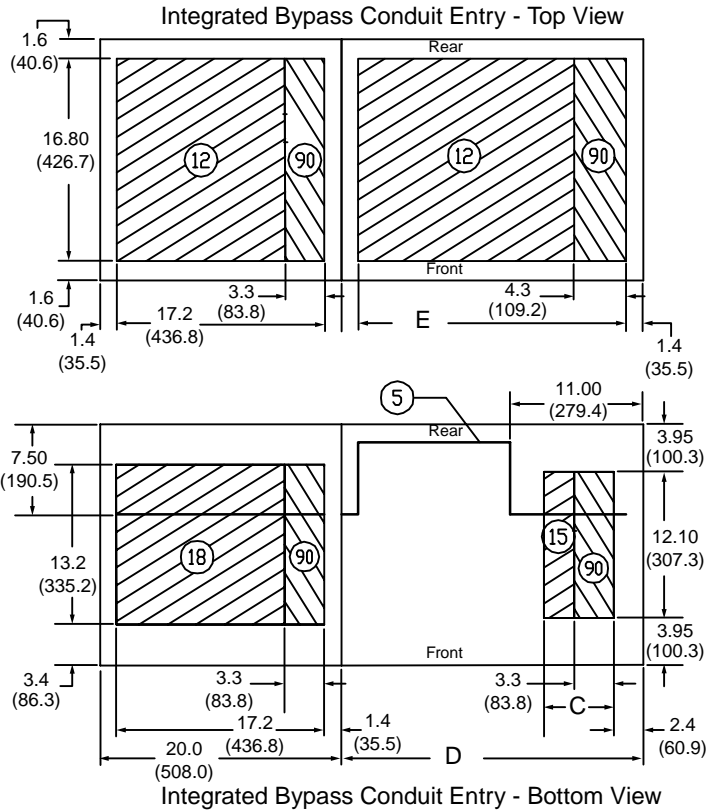
Dimensions: in. (mm)

NOTE: Circled numbers indicate depth in inches from the conduit entry plate to the nearest obstruction for wiring.

Anchor Mounting Holes



NOTE: Use 1/2 in. or 3/4 in. diameter grade 5 bolts to secure the floor-mounted structure.



Class 8839 58M Enclosed AC Drives Application Information

When selecting and applying AC Drives, the following items should be considered where they are applicable. Proper selection and application of an AC Drive is essential to ensure reliable operation and maximum performance of the connected motor load. Please consult Product Data Bulletin **SC100 R5/95** "Adjustable Frequency Controllers Application Guide" for further details.

1. AC Drive selection
2. Ambient temperature/altitude
3. AC Line & motor voltage
4. Power factor
5. Harmonics
6. Input currents with and without line reactors
7. Drive isolation transformer
8. Speed range & regulation
9. Accelerating torque
10. Dynamic braking
11. Follower signals
12. PI regulator
13. Bypass operation
14. Motor selection
15. Enclosure types
16. Relay contact ratings

AC Drive Selection

The Class 8839 58M Enclosed AC drive is selected based on the connected motor full load current. AC drives in this catalog are listed by horsepower, voltage and maximum continuous output current ratings that align to the latest NEC ratings. The motor horsepower rating may be used to select the AC drive, provided its full load current does not exceed the maximum continuous output current rating of the drive. When the motor full load current does exceed the maximum continuous output rating of the AC drive, a larger one must be selected.

In multi-motor applications the sum of the motor full load current, not horsepower must be used to select the appropriate AC drive.

Ambient Temperature/Altitude

The AC Drive and connected motor is rated to operate in an ambient temperature of 0–40 °C (32–104 °F), and deliver full rated horsepower nameplate data. When ambient temperatures exceed the 40 °C (104 °F) operational ambient environment, both the AC drive and motor must be derated. For installations that require a higher operating ambient, derate by one horsepower size to a maximum of 50°C (122 °F).

The Class 8839 58M Enclosed AC drives are also rated for up to 3,300 feet (1,000 meters) altitude without derating. Above these ratings, the AC drive must be derated by 1.2% for every 300 feet (100 meters) up to a maximum of 6,600 feet (2,000 meters). For conditions where altitude exceeds 6,600 feet, special considerations apply. Environment, application, loading, and ambient operating conditions could extend altitude range.

AC Line & Motor Voltage

The Class 8839 58M Enclosed AC drives are designed for operation under continuous rated input power from 208 V, 230 V and 460 V line voltages, $\pm 10\%$ at 50/60 Hz. The selection tables list the horsepower available at the different voltage ratings. Alternate line voltage configurations are also available on a special order basis. Consult the Drives Applications Group for those applications.

Normally, input voltage and motor voltage will be the same, however, certain applications requiring constant torque above 60 Hz base speed will involve connecting the AC drive to a 460 V supply and connecting the motor for 230 V at 60 Hz. The AC drive can be adjusted to provide 230 V out at 60 Hz and 460 V out at 120 Hz. If this mode of operation is desired, the AC drive must be selected based on the full load current at 230 V.

Power Factor

The Class 8839 58M Enclosed AC drive uses bridge rectifiers which convert the fixed voltage and frequency from the AC line to a fixed DC bus voltage. Operation of the rectifiers does not cause any additional displacement between the voltage and current on the AC line feeding the AC drive.

This means that the displacement power factor (power factor measured by the utility) will not be degraded. Therefore, the AC drive power factor is rated 0.95 or better (lagging) at all times.

Harmonics

Concerning the subject of harmonics, all types of adjustable speed drives using power semiconductors and switching power supplies will produce harmonic currents, which will cause a non-sinusoidal voltage in the power system. The suggested guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", which suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers.

Class 8839 58M Enclosed AC Drives Application Information

Collectively, all facility loads and the building electrical distribution network determines the harmonic levels at the user & electric utility interface. Commonly misapplied, the Electrical Power Research Institute (EPRI) recognizes the 'Point of Common Coupling' or PCC as the interface between user and electric utility (energy meter) in the electrical distribution network. This position will also be supported in the forthcoming Application Guide (P519A) being prepared by the Harmonics Working Group of IEEE. Square D Company will typically provide 'drive isolation transformers' or 'line reactors' as the most cost effective method of harmonic abatement.

For specifications that are regulated by utilities to the IEEE 519 guidelines, there are alternate methods of harmonic abatement. Consult product support or customer service for enclosed drives for configurations and pricing.

Input Currents Ratings (with and without Line Reactor)

Square D publishes input currents based on distribution system impedance at various available fault current ratings. Our literature reflects multiple input current ratings based on available fault currents

- 5,000 AIC (1–50 hp) or
10,000 AIC (60–200 hp) or
18,000 AIC (250–400 hp)
and
- 22,000 AIC
and
- 65,000 AIC
and
- 100,000 AIC

More common, line reactors are provided with the majority of AC Drives today. The reasons proliferate from abnormal line conditions, IEEE 519 guidelines, to power quality concerns. Line reactors provide the most cost effective option to minimize harmonic currents reflected back into the distribution system. The use of line reactance ahead of the AC drive will function best to:

1. Reduce line current harmonic injection into the primary source, limiting the input 'rms' currents to less than or equal to motor full load amps.
2. Reduce the available feeder short circuit capacity.
3. Meet specified line impedance requirements. 5 KAIC, 10 KAIC, 22 KAIC, and 65 KAIC short circuit current rating up to 100 hp, and 65

KAIC and 100 KAIC short circuit current rating for 125–500 hp. By listing the alternate input currents when using a series line reactor, the user could benefit in savings reflected in conductor and disconnect selection, as required by the National Electric Code.

Drive Isolation Transformer

Drive Isolation transformers are designed for maximum benefit when applied to an AC drive. In addition to the functional comparison of a line reactor, drive isolation transformers are normally used for one of the following reasons over a standard line reactor:

1. Match system voltage to drive rating.
2. Meet local or plant codes that require isolation.
3. Capable of correcting line voltage unbalance conditions commonly seen with open delta and corner grounded delta distribution systems.
4. Provides continuity of service for nuisance grounding.
5. Reduces drive induced currents in supply feeder ground and limit ground fault currents.
6. Isolate the electrical common mode noise generated in solid state controllers from the distribution system.

The Class 8839 58M Enclosed AC drives have a high fault withstand capability (up to 65,000 A or 100,000 A depending upon configuration). For these reasons, Square D does not suggest the use of a drive isolation transformer for isolation purposes unless the system requires one or more of the six functions listed above.

Speed Range & Regulation

The Class 8839 58M Enclosed AC drives will operate within the range of 0.1 to 60 Hz (configurable up to 500 Hz). Please note, if operating motors above base speed, the motor manufacturer must approve operation for the specified speed range.

Speed regulation is determined by one of several modes of configuration. Most AC drives utilize the volts/hertz mode where speed regulation is determined by the motor slip, typically 3% or less. The Class 8839 58M Enclosed AC drive utilizes sensorless flux vector mode (SLFV) as standard with 1% speed regulation; with optional tachometer can be improved to 0.5%.

Class 8839 58M Enclosed AC Drives

Application Information

Accelerating Torque

AC induction motors built to NEMA standards are designed to provide starting torque which must meet certain minimum ratings. This is normally expressed as a percentage of full load torque. These torque ratings are valid only for full voltage starting where inrush current can be approximately 600% of motor full load current. The Class 8839 58M Enclosed AC drive will limit starting current to a value of usually not more than 150% (CT rated) to 110% (VT rated) of drive full load current, which provides approximately 150% starting torque for CT loads and 110% for VT loads.

AC Drives provide better torque per ampere than any other reduced inrush method, but the starting torque available may be less than the starting torque available with an across-the-line starter. Applications with known high starting torque requirements should be carefully evaluated. It may be necessary to oversize the AC Drive, or the motor to provide the necessary accelerating torque.

Dynamic Braking

Dynamic braking directs the regenerative energy from an AC induction motor dissipated in the form of heat through a resistor. This condition presents an electrical load, or retarding torque, to the motor, which is acting as a generator. The thermal capacity required for this resistor is determined by the stopping duty cycle for the load and the energy dissipated for each deceleration.

Dynamic braking requires the motor to remain energized to maintain the rotating magnetic field. Dynamic braking cannot operate during periods where power is lost and cannot maintain holding torque when the AC Drive is stopped. A mechanical brake must be used when the application requires a holding torque at zero speed.

A dynamic braking resistor configuration is available as optional equipment. The dynamic braking resistor is sized to be capable of absorbing six times the stored energy of a motor at maximum speed, which means it could make 6 consecutive stops from rated speed without overheating. Applications with high inertia are typical candidates for dynamic braking.

Follower Signals

The Class 8839 58M Enclosed AC drives are designed to accept a 4–20 mA_{dc} or optional 0–10 V_{dc} analog input, or an optional 3–15 psig analog input. Other follower signals may be

accommodated which will require additional hardware or signal conditioners as optional equipment.

PI Regulator

The Class 8839 58M Enclosed AC drive has a built in PI regulator to provide set-point control from the key pad or remote analog signal. Selection parameters are set via the key pad to automatically control a level, pressure or flow process. This PI function does not require any additional hardware, such as options boards or separately mounted equipment.

Bypass Operation

Although the Class 8839 58M Enclosed AC drive is designed for maximum reliability, it is possible that a controller could be out of service when required to operate. Critical operations which can tolerate little or no down time should be considered as candidates for bypass (full speed) operation.

This involves an isolation contactor to disconnect the motor from the AC Drive and a full voltage starter to bypass the controller and operate the motor across-the-line or by an alternate starter such as a reduced voltage autotransformer starter or a solid state reduced voltage starter.

Motor Selection

The Class 8839 58M Enclosed AC drives are designed to operate with any three phase AC squirrel cage induction motor or synchronous reluctance motor having voltage and current ratings compatible with the drive.

It is recommended that all motors used with AC Drives be equipped with thermostats in the stator windings. This affords the ultimate motor overload protection much better protection than overload devices sensitive to motor current, because motor temperature may rise due to loss of cooling resulting from low speed operation and not necessarily because of an overcurrent condition.

The motor should meet NEMA MG-1, Part 31 standards. This motor spec calls for 1600 volt rated magnet wire, while the NEMA MG-1, Part 30 standard calls for 1000 volt rated magnet wire. The higher voltage rated magnet wire will protect against possible premature motor failures due to voltage stress from fast dv/dt rise times commonly seen with IGBT based AC Drives.

Class 8839 58M Enclosed AC Drives Application Information

Enclosure Types

The Class 8839 58M Enclosed AC drives are available in Type 1, Type 1G, or Type 12 enclosures. If Type 3R, 4, or 4X enclosures are required, consult product support or customer service for enclosed drives.

Outside installations requiring drives should be quoted for installation in climate controlled Type 3R walk-in enclosures available separately from our Power Zone Center group in Smyrna, TN.

Specifications for Drive Controllers

Input voltage	460 V \pm 10%, 230 V \pm 10%, 208 V \pm 10%
Displacement power factor	98% through speed range
Input frequency	60 Hz \pm 5%
Output voltage	Three-phase output Maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, and power supplies)
Frequency range of power converter	0.1 to 500 Hz (factory setting of 60 Hz)
Torque/overtorque	110% of nominal motor torque for 60 s (VT) 150% of nominal motor torque for 60 s (CT)
Current	110% of controller rated current for 60 s
Switching frequency	Selectable from 0.5 to 16 kHz ^[1] Factory setting: 4 kHz CT, 8 kHz for 208 V, 230 V, and 1–100 hp @460 V VT 2 kHz for 125–500 hp @ 460 V VT
Speed reference	A11: 0 to +10 V, Impedance = 30 k Ω Speed potentiometer to A11 A12: factory setting: 4 to 20 mA, Impedance = 100 Ω (reassignable, X–Y range with keypad display). Factory modification J10 provides a controller interface 0–10 Vdc reference signal to the A12 input using a 0–10 V / 4–20 mA converter with Z= 40 k Ω .
Frequency resolution in analog reference	0.1 for 100 Hz (10 bits)
Speed regulation	V/f: determined by motor slip, typically 3% Sensorless flux vector (SLFV): 1%
Efficiency	97% at full load typical
Reference sample time	5 ms
Acceleration and deceleration ramps	0.1 to 999.9 s (definition in 0.1 s increments)
Drive controller protection	Thermal protection of transformer, rectifier, and power converter Phase loss of AC mains Circuit breaker rated at 65 kAIC
Motor protection	Class 10 electronic overload protection Class 20 electromechanical overload protection with bypass ^[2]
Keypad display	Self diagnostics with fault messages in three languages; also refer to instruction bulletin VVDED397047US
Temperature	Storage for all enclosures: -13 to +149 °F (-25 to +65 °C) Operation: +14 to +104 °F (-10 to 40 °C)
Humidity	95% with no condensation or dripping water, conforming to IEC 60068-2-3.
Altitude	3,300 ft (1000 m) maximum without derating; derating of the current by 1% for each additional 330 ft (100 m)
Enclosure	Type 1: all controllers Type 1G: 125–500 hp @ 460 V VT only Type 12: all except 125–500 hp @ 460 V VT

- 1–100 hp switching frequency is factory set below 4 kHz. If operation above 4 kHz (CT) or 8 kHz (VT) is required, select the next largest size drive controller. 125–500 hp switching frequency is factory set at 2 kHz. If operation above 2 kHz is required, select the next largest size drive controller.
- Class 10 electromechanical for 1 hp @ 460 V.

Relay Contact Ratings

Interposing relay contacts are available for customer use. Contacts are available for run and fault indication as standard. Optional contacts (if selected) provide indication of bypass on, auto mode, and communication mode. Relay contacts are rated for switching inductive loads and have a 5 A continuous current rating.

Class 8839 58M Enclosed AC Drives

Application Information

Specifications for Drive Controllers (Continued)

Pollution degree	Type 1, 1G: Pollution degree 2 per NEMA ICS-1 Annex A and IEC 60664-1 Type 12: Pollution degree 3 per NEMA ICS-1 and IEC 60664-1
Operational test vibration	Conforming to IEC 60721-3-3-3M3 amplitude 1.5 mm peak to peak from 3 to 13 Hz 1 g from 13 to 200 Hz
Transit test to shock	Conforming to National Safe Transit Association and International Safe Transit Association test for packages.
Operational shock	15 g, 11 ms
Codes and standards	UL Listed per UL 508C under category NMMS. Conforms to applicable NEMA ICS, NFPA, and IEC standards. Manufactured under ISO 9001 standards. Factory modification G10 provides Canadian cUL certification.

- 1–100 hp switching frequency is factory set below 4 kHz. If operation above 4 kHz (CT) or 8 kHz (VT) is required, select the next largest size drive controller. 125–500 hp switching frequency is factory set at 2 kHz. If operation above 2 kHz is required, select the next largest size drive controller.
- Class 10 electromechanical for 1 hp @ 460 V.

ENCLOSED ADJUSTABLE FREQUENCY DRIVES (1 TO 500 HP)

Note to Specifier: These specifications apply to Enclosed Adjustable Frequency Drive Controllers, herein referred to as AC Drives. The power converter is a component of the AC Drive. To ensure project compatibility, these specifications follow the Construction Specifications Institute (CSI) format. Copies of this specification are available from the Square D® website, www.squared.com. Application information directly affects the type and rating of AC Drive that will be quoted. [Brackets] are provided where such data and options should be included or considered depending on application requirements. Please contact your local Square D distributor or sales representative for specification assistance regarding a particular application. The AC Drive specification should be included in Division 16 (Electrical) for proper coordination with the electrical distribution system.

PART 1 GENERAL

1.01 SCOPE OF WORK

- a. This section provides specification requirements for adjustable frequency drives, variable speed drives or herein identified as AC Drives for use with NEMA® B design AC motors.
- b. The AC Drive manufacturer shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.
- c. Any exceptions/deviations to this specification shall be indicated in writing to the specifying engineer and submitted with the quotation.

1.02 REFERENCES

- a. NFPA-70 (2002) "National Electric Code (NEC®)"
- b. ANSI C84.1 (R2002) "Electric Power Systems and Equipment - Voltage Ratings (60Hz)"
- c. CSA® C22.2 No.14-95 (R2001) "Industrial Control Equipment"
- d. UL508A (2003) "Standard for Safety for Industrial Control Panels"

- e. UL508C (2002) "Standard for Safety for Power Conversion Equipment"
- f. NFPA 79 (2002) "Electrical Equipment of Industrial Machines/Industrial Machinery"
- g. NEMA ICS7 (2000) "Industrial Control and Systems: Adjustable Speed Drives"
- h. NEMA ICS7.1 (2000) "Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems"
- i. NEMA 250 (1997) "Enclosures for Electrical Equipment (1000V maximum)"
- j. IEC 61800-2 (1998-03) "Adjustable speed electrical power drive systems - Part 2: General requirements - rating specifications for low voltage adjustable frequency AC power drive systems"
- k. IEC 61800-3 (1998-06) "Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods"
- l. IEC 61800-5-1 (2003-02) "Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy"
- m. IEC 61800-6 (2003-03) "Adjustable speed electrical power drive systems - Part 6: Guide for determination of types of load duty and corresponding current ratings."
- n. EGSA 101P (1995a) "Engine Driven Generator Sets - Performance Standard"
- o. IEEE 519 (1992) "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems"

1.03 SUBMITTALS

- a. [6] copies of approval drawings shall be furnished for Engineer's approval prior to factory assembly of the AC Drives. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations and nameplate legend details.
- b. Standard catalog sheets showing voltage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated AC Drive provided.

Class 8839 58M Enclosed AC Drives Specifications

1.04 WARRANTY

- a. An 18-month parts warranty shall be provided on materials and workmanship from the date of invoice from an authorized distributor.

1.05 QUALITY ASSURANCE

- a. The manufacturer of the AC Drive shall be a certified ISO 9001 facility.
- b. The AC Drive and all associated optional equipment shall be UL LISTED according to UL508C Power Conversion Equipment. A UL label shall be attached inside each enclosure as verification.
- c. The AC Drive shall be designed constructed and tested in accordance with NEMA, NEC, VDE, IEC standards.
- d. Every power converter shall be tested with an actual ac induction motor, 100% load and temperature cycled within an environmental chamber at 104 °F. Documentation shall be furnished to verify successful completion at the request of the engineer.
- e. All Drive door mounted pilot devices shall be tested to verify successful operation. Documentation shall be furnished upon written request of the engineer.
- f. The AC Drive shall undergo QA test procedures and be submitted to a hi-pot test with all enclosed devices mounted and wired, prior to shipment.

PART 2 PRODUCT

2.01 MANUFACTURERS

- a. The AC Drive shall be provided by Square D/ Groupe Schneider, Class 8839 58M Enclosed, Class 8839 Type CPDM "PowerGard™" or prior approved equal. Substitutions must be submitted in writing three (3) weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.
- b. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

2.02 GENERAL DESCRIPTION

Note to Specifier: For AC Drives rated up to 100 hp, the most practical harmonic mitigation technique can be line reactors, isolation transformers or harmonic suppressors dependent upon the type of power quality concerns. For AC Drives rated 125 hp and above, 18-Pulse offers a premium level of harmonic mitigation.

- a. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined below.
 1. For AC Drives rated up to 100 hp, the AC Drive manufacturer shall use a 6-Pulse bridge rectifier design [with line reactors, isolation transformers for effective harmonic mitigation]. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. The power section shall be insensitive to phase rotation of the AC line.
 2. For AC Drives rated 125 hp and above, the AC Drive manufacturer shall supply an 18-Pulse topology using a multiple bridge rectifier design with integral reactor and phase shifting transformer. The 18-Pulse configuration shall result in a multiple pulse current waveform that approximates near sinusoidal input current waveform. The power section shall be insensitive to phase rotation of the AC line.
- b. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall use insulated gate bipolar transistors (IGBT) or intelligent power modules (IPM) as required by the current rating of the motor.

2.03 CONSTRUCTION

- a. AC Drives rated 25 hp VT at 460 Vac and less shall be supplied in wall mounted enclosures unless compartmentalized, floor mounted enclosures are required for Barrired Bypass construction. (See Emergency Full Speed Requirements.) AC Drives rated 30 hp VT at 460 Vac and above shall be supplied in floor mounted enclosures.
- b. Seismic ratings and certifications shall be provided for all floor mounted enclosures. The seismic ratings shall meet IBC 2000, NFPA 5000, ASCE 7-02, UBC zone 4, CDC zone 4 and the 1995 NBCC with exceptions for application in the British Columbia area and the New Madrid Hazard Zone. Verification of testing shall be in accordance with ICC AC156 Acceptance Criteria testing procedures. Enclosures shall exhibit a certification label on the inside enclosure door stating compliance to these requirements.
- c. The AC Drive shall be mounted in a [Type 1, Type 12] enclosures with an external operated disconnect device. For AC Drives greater than 75 hp (CT) or 100 hp (VT), NEMA Type 12 or Type 1G ventilated enclosures with gaskets and filters are acceptable.

Class 8839 58M Enclosed AC Drives Specifications

- d. There shall be no restriction on space requirements between floor mounted enclosures
- e. A mechanical interlock shall prevent personnel from opening the AC Drive door when the disconnect is in the "ON" position. It shall be possible for authorized personnel to defeat this interlock. Provisions shall be provided for locking all disconnects in the off position with up to three padlocks. Provisions shall also be made for accepting a padlock on the circuit breaker disconnect, preventing movement of the disconnect to the "ON" position when the door is open.
- f. Provisions shall be made for both top and bottom conduit entry. Conduit knockouts shall be provided for wall mounted enclosures. Removable conduit entry plates shall be provided for floor mounted enclosures.
- g. All fans within an enclosed AC Drive including the AC Drive heatsink fans shall be front accessible and removable without removal of the AC Drive power converter to facilitate maintenance and or fan replacement.
- h. Control wiring shall have permanent wire markings printed on the wire insulation. Both ends of the control wiring shall contain wire markings per the as built control elementary diagram. Red control wiring shall be used for 115Vac control circuits and blue control wiring shall be used for 24V control circuits.
- i. All AC Drive enclosure shall be painted ANSI 49 Gray. The enclosure interior shall include a white mounting surface for control and power component mounting for improved visibility.

2.04 MOTOR DATA

- a. The AC Drive shall be sized to operate the following AC motor:
 - Motor Horsepower
[1,2,3,5,7.5,10,15,20,25,30,40,50,60,75,100,
125,150,200,250,300,350,400,450,500]
 - Motor full load ampere [specify rating
coordinated to NEC Table 430-150]
 - Motor RPM [3600/3000,1800/1500,
1200/1000,900/750,720/600,600/500] at
60 Hz
 - Motor voltage [208,230,460]
 - Motor service factor [1.0,1.15,1.25]

2.05 APPLICATION DATA

- a. The AC Drive shall be sized to operate a [Variable Torque, Constant Torque] load.
- b. The speed range shall be from a minimum speed of 0.5 Hz to a maximum speed of 400 Hz.

2.06 ENVIRONMENTAL RATINGS

- a. The AC Drive shall be of construction that allows operation in a pollution Degree 3 environment. The AC Drive shall meet IEC 60664-1 and NEMA ICS 1 Standards. AC Drives that are only rated for Pollution Degree 2 environment shall not be allowed.
- b. The AC Drive shall be designed to operate in an ambient temperature from 0 to + 40 °C (+32 to 104 °F).
- c. The storage temperature range shall be -25 to + 70 °C (-13 to 158 °F).
- d. The maximum relative humidity shall be 95% at 40 °C (104 °F), non-condensing.
- e. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 ft (1000 m). For altitudes above 3,300 ft, de-rate the AC Drive by 1% for every 300 ft (100 m).
- f. The AC Drive shall meet the IEC 60068-2 Operational Vibration Specification.

2.07 RATINGS

- a. The AC Drive shall be designed to operate from an input voltage of 460 ± 10% Vac or 208 -15% to 230 +15% Vac.
- b. The AC Drive shall operate from an input voltage frequency range of 60 Hz ± 2%.
- c. The displacement power factor shall not be less than .95 lagging under any speed or load condition.
- d. The efficiency of the AC Drive at 100% speed and load shall not be less than 96%.
- e. The [constant, variable] torque rated AC Drive overcurrent capacity shall be [150%, 110%] for one minute.
- f. The output carrier frequency of the AC Drive shall be randomly modulated and selectable at 2, 4, or 10 kHz depending on Drive rating for low noise operation. No AC Drive with an operable carrier frequency above 10 kHz shall be allowed.
- g. The output frequency shall be from 0.1 to 400 Hz for AC Drives up to 75 hp. For horsepower ratings above 75 hp, the maximum output frequency will be 200 Hz.

Class 8839 58M Enclosed AC Drives Specifications

- h. The AC Drive will be able to develop rated motor torque at 0.5 Hz (60 Hz base) in a sensorless flux vector (SVC) mode using a standard induction motor without an encoder feedback signal.

2.08 PROTECTION

- a. Circuit breaker coordination and short circuit protection shall eliminate the need for current-limiting and semiconductor fuses. Manufacture who require the use of semiconductor or current limiting fused will not be approved.
- b. The AC Drive shall be UL 508C listed for use on distribution systems with [5,000 A, 10,000 A, 22,000 A, 65,000 A RMS] available fault current. The AC Drive shall have a coordinated short circuit rating designed to UL 508C and NEMA ICS 7.1 and listed on the nameplate. The AC Drive shall not create a hazard in the event of a short circuit at any point within the AC Drive when it is connected to a power source as specified on the nameplate and protected as specified in the instruction bulletin
- c. Provisions shall be made to padlock the circuit breaker in the off position when the enclosure door is open.
- d. Upon power-up the AC Drive shall automatically test for valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power and the pre-charge circuit.
- e. The Power Converter shall be protected against short circuits, between output phases and ground; and the logic and analog outputs.
- f. The AC drive shall have a minimum AC undervoltage power loss ride-through of 200 msec. The AC Drive shall have the user-defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the powerloss ride-through.
- g. The AC drive shall have a selectable ride through function that will allow the logic to maintain control for a minimum of one second without faulting.
- h. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 255 programmable restart attempts. The programmable time delay before restart attempts will range from 1 second to 999 seconds.

- i. The deceleration mode of the AC drive shall be programmable for normal and fault conditions. The stop modes shall include free-wheel stop, fast stop and DC injection braking.
- j. Upon loss of the analog process follower reference signal, the AC Drive shall fault and/or operate at a user-defined speed set between software programmed speed settings or last speed.
- k. The AC drive shall have solid state thermal protection that is UL Listed and meets UL 508C as a Class 20 overload protection and meets IEC 947. The minimum adjustment range shall be from .25 to 1.36% of the current output of the AC Drive.
- l. There shall be three skip frequency ranges with a bandwidth of 5 Hz. The skip frequencies shall be programmed independently, back to back or overlapping.

2.09 ADJUSTMENTS AND CONFIGURATIONS

- a. The AC Drive shall self-configure to the main operating supply voltage and frequency. No operator adjustments will be required.
- b. Upon power-up, the AC Drive will automatically send a signal to the connected motor and store the resulting resistance data into memory. The inductance data will be measured during no-load operation when operating at a frequency between 20-60 Hz. The AC Drive shall automatically optimize the operating characteristics according to the stored data.
- c. The AC Drive will be factory pre-set to operate most common applications.
- d. A choice of three types of acceleration and deceleration ramps will be available in the AC Drive software; linear, S curve and U curve.
- e. The acceleration and deceleration ramp times shall be adjustable from 0.1 to 999.9 seconds.
- f. The volts per frequency ratios shall be user selectable to meet variable torque loads, normal and high-torque machine applications.
- g. The memory shall retain and record run status and fault type of the past eight faults.
- h. Slip compensation shall be a software-enabled function.
- i. The software shall have a NOLD (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

Class 8839 58M Enclosed AC Drives Specifications

- j. The AC Drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current will be adjustable between 50-150% of rated current and available from 0.0-30 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.
- k. Sequencing logic will coordinate the engage and release thresholds and time delays for the sequencing of the AC Drive output, mechanical actuation and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2.10 OPERATOR CONTROLS

Note to Specifier: Select the operator control strategy that is appropriate for application requirements.

- a. Industrial rated 22mm type control operators and pilot devices shall be door mounted and used independently of the keypad display to select operator control modes of [Hand-Off-Auto, Communication-Auto-Off-Hand, Hand-Off-Auto Start Stop, Hand-Off-Auto Local-Remote]. A door mounted manual speed potentiometer shall be used to control speed in the Hand mode of operation. Control modes shall function as follows:

1. *Hand* – The Hand mode shall allow manual operation of start, stop and speed control. The AC drive shall start when the control operator is in the Hand mode and run at low speed setting of the drive or higher as required by the position of the manual speed potentiometer. This mode shall function as 2-wire control and automatically restart after a power outage or auto restart after fault.
2. *Off* - The Off position of the control operator shall stop the AC drive and prevent it from restarting while in the Off position. This position shall also reset the AC Drive after a fault condition has occurred.
3. *Auto* - The Automatic mode shall receive an auto start contact rated 115VAC to control start and stop of the AC Drive. This contact shall also start and stop bypass (if used) when both the Automatic mode and Bypass modes of operations are selected. In Automatic mode the user shall remotely reset the AC Drive by opening and closing the Auto-start contact. Speed control shall

be from a customer supplied [4-20mA, 0-10Vdc] signal.

4. *Comm* – The communication mode shall allow start, stop and speed control over network communication. (See Communication and Network Requirements.)
 5. *Start-Stop* – Start / Stop pushbuttons shall provide 3-wire start stop control when the drive is in the hand position. The stop push button shall only be active in the Hand mode of operation.
 6. *Local Remote* – Local / Remote selector switch shall provide speed reference control between a manual speed potentiometer and the remote speed reference when in the Auto mode of operation.
- b. The AC Drive shall include door-mounted “Power On”, “AFC Run”, “AFC Fault”, “Auto/Comm” mode and “Bypass” pilot lights. All pilot lights except “Power On” shall be Push-to-Test configurations.

2.11 AC DRIVE SEQUENCING REQUIREMENTS

Note to Specifier: Specifying a run command relay provides an interface for customer supplied 115Vac safeties and interlocks such as limit switches, flow or temperature switches. This control sequence ensures an AC Drive will stop in any control mode if safeties are opened.

- a. All Enclosed AC Drives shall have 115VAC interface and control sequencing. A Run Command Relay (RCR) shall function as a “request to run / run permissive” and close only when all customer wired safeties and control operator conditions calling for run are satisfied. The RCR relay shall prevent drive operation in any operating mode including network communication if the RCR relay conditions are not satisfied. A Drive Run Relay (DRR) shall provide run indication and interfacing to bypass (if used) and other system control sequencing as specified.

Class 8839 58M Enclosed AC Drives Specifications

2.12 SYSTEM CONTROL AND INTERFACE REQUIREMENTS

Note to Specifier: Select the additional control functions that are appropriate for application requirements.

- a. The following additional controls and interface requirements shall be provided:
 1. *Smoke Purge* – The AC Drive shall provide a smoke purge interface relay. This relay, when closed will force the AC Drive to operate at the high speed setting (HSP) of the drive controller independent of any control setting or interlock. If full speed bypass is provided, the drive shall operate on bypass when the smoke purge relay is closed, independent of any system interlocks.
 2. *Fire / Freeze Stat Interlocks* – The AC drive shall provide interlock wired to user terminals. Open interlocks shall prevent drive or bypass operation unless a smoke purge relay is provided and closed.
 3. *Damper End Switch* – The AC Drive shall provide a damper control circuit to coordinate the position of a damper to open before the motor is started either in AFC or Bypass. This circuit shall also provide maximum power of 40 VA sealed and 100 VA into the damper solenoid.
 4. *Seal Water Solenoid* – The AC Drive shall provide 120 Vac / 50 VA to operate the seal water solenoid whenever the motor is energized.
 5. *Moisture Detection* – The AC Drive shall provide a moisture detection circuit to indicate the presence of moisture in the windings of a submersible pump and prevent drive or bypass operation if moisture is detected.
 6. *Check Valve Sequencing* – The AC Drive shall provide a circuit that shuts down the drive whenever a user supplied check valve limit switch does not open within a specified time. This circuit shall provide an illuminated reset push button to indicate improper sequence.
 7. *Motor Space Heater Sequencing* – The AC Drive shall provide 120Vac/50VA to operate motor space heater when the motor is not running.
 8. *Motor Elapsed Time Meter* – The AC Drive shall provide an elapsed time meter which operate whenever the motor runs.

9. *Auxiliary Contacts* – The AC Drive shall provide the following auxiliary contacts to indicate the following conditions:
 - 2 N.O. contacts to indicate DRIVE RUN
 - 1 N.C. contact to indicate DRIVE RUN
 - 1 N.O. contact to indicate DRIVE FAULT
 - 2 N.C. contacts to indicate DRIVE FAULT
 - 1 N.O. contact to indicate BYPASS RUN
 - 1 N.O. contact to indicate AUTO/COMM MODE

2.13 COMMUNICATION AND NETWORKING REQUIREMENTS

Note to Specifier: Specifying a communication relay serves two important user safety concerns when using network communications:

1. Ensures that communication can not start an AC Drive when safety interlocks (limit, pressure, temperature or flow switches and/or Emergency Stop circuits) that are not part of the communication network are in an open state.
 2. Ensures that network communications can not start, stop, or change the speed of an AC Drive, when a control mode other than communication is selected.
- a. A Communication Mode Relay (CMR) shall close when operator controls are in the communication position. Contacts from the CMR relay shall pick up the run command relay if all safety conditions are met. Contacts from the CMR relay shall also provide pilot light indication when the AC Drive is in the communication mode. The CMR relay shall allow monitoring using network communication in any operator control mode. Network communication of start, stop, and speed control shall be limited to the communication mode when operator controls are in the communication position.
 - b. The following Ethernet TCP/IP communication card and protocol shall be mounted and wired within the enclosed AC Drive.
 - c. The AC Drive shall accept an Ethernet communications card that includes embedded web-pages.
 1. The embedded web-pages shall provide the ability to configure, control, monitor and diagnose the AC drives via a standard web-browser such as Internet Explorer or

Class 8839 58M Enclosed AC Drives Specifications

- Netscape Navigator. No additional software should be required.
2. The embedded web-pages shall be secured by use of a customizable user name and password.
 3. Standard Ethernet hubs, switches and routers can be used, although industrial grade devices are recommended if the environmental conditions warrant.
 4. The Ethernet Communications Card shall support the following services via the standard Ethernet Port 502:
 - a) TCP/Modbus Client, with support for periodic I/O Scanning
 - b) HTTP Server for drive configuration, control, and monitoring.
 - c) ICMP client to support certain IP services such as the "ping" command.
 - d) BOOTP client to assign an IP Address via an address server.
 5. The Ethernet Communications card shall have diagnostic LED that monitor communication

Note to Specifier: One of the following communication cards can be specified lieu of Ethernet Communication:

Modbus / Unitelway, Modbus Plus, LonWorks, Device Net, Johnson Controls METASYS N2, FIP I/O

2.14 MESSAGE DISPLAY CENTER REQUIREMENTS

- a. The message display center / keypad display shall be menu based and offer the modification of AC Drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local keypad control, and adjustment storage will be in plain English.
- b. The display will be a high-resolution, backlighted LCD screen capable of displaying 4 lines of 20 alphanumeric characters.
- c. The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall all be listed on the drive identification display as viewed on the LCD display.
- d. The keypad interface shall be configured to display selectable outputs such as speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference and machine speed.

- e. The operator terminal shall provide a main menu consisting of status, programming, drive configuration, and keypad operation. A hardware jumper lock shall protect drive setup from unauthorized personnel by limiting access to the programming and drive configuration menus. A software password shall be configured to limit access to all menus except status. The status menu shall show meters, I/O map, fault history and drive identification.
- f. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions or increase the value of a selected parameter.
- g. A data entry key will allow the user to confirm a selected menu, numeric value or allow selection between multiple choices.
- h. An escape key will allow a parameter to return the existing value if adjustment is not required and the value is displayed. The escape function will also return to a previous menu display.
- i. A RUN key and a STOP key will command a normal starting and stopping as programmed when the AC Drive is in keypad control mode. The STOP key must be programmable for active in all control modes.
- j. The keypad interface shall have three backlight colors to indicate functional status. A green color backlight will verify that the AC Drive is running. A red color backlight will indicate an AC Drive fault. An orange color backlight color will designate and idle or drive ready status.
- k. The keypad and all door mounted controls must be [Type 1, Type 12] rated.

2.15 EMERGENCY FULL SPEED REQUIREMENTS

- a. The AC Drive shall include fully rated isolation and bypass contactors complete with Class 20 thermal overload relay protection for emergency full speed capability. Bypass and isolation contactor shall be mechanical and electrical interlocked. Emergency full speed bypass shall be [full voltage cross the line, solid state reduced voltage soft starter, reduced voltage autotransformer type.] Bypass and isolation contactors shall be in [Integrated, Barrired] construction.
 1. Integrated bypass shall consist of integrating bypass and isolation contactors into the same enclosure compartment as the AC drive controller if space permits.

Class 8839 58M Enclosed AC Drives Specifications

One disconnect shall be common to the drive controller and bypass contactor.

2. *Barriered bypass shall consist of compartmentalized, multi-door enclosure construction that provides electrical isolation of the AC Drive controller from the bypass contactor using two OSHA and UL approved disconnects. This configuration shall remove all power to the drive controller compartment when the drive disconnect is in the open position. This configuration shall allow provide maximum user flexibility if servicing a drive while remaining on bypass.*
- b. A TEST-NORMAL selector switch shall be used with bypass to allow testing of the AC Drive without running the motor. In the "Test" position the isolation contactor shall remain open preventing motor operation while operating the AC drive.
- c. The operator shall have full operational control of the bypass starter using a door mounted AFC/OFF/BYPASS selector switch.
- d. Auto transfer to bypass function shall be provided in the event of drive fault or failure. This feature shall be enabled or disabled by an internally mounted selector switch. An adjustable timer shall provide control of the delay time between fault and transfer to bypass.

2.16 HARMONIC MITIGATION EQUIPMENT REQUIREMENTS

Note to Specifier: There are several solutions for effective harmonic mitigation. The most common approach is the use of a 5% line reactor. When line reactors are properly sized for the drive controller, the additional source impedance can add provide effective levels of harmonic mitigation for voltage distortion and attenuation of incoming voltage transients. The alternate approaches include the use of isolation transformers and harmonic filters. The typical installation of isolation transformers and filters are separately mounted with proper branch circuit protection. Filters require coordination with the AC Drive power circuit and must not be part of the bypass path. An alternate approach is the use of multi-pulse drives, which are typically specified above 100 hp.

- a. The AC Drive shall be provided with a 5% rated line reactor mounted inside the enclosure.
- b. The AC Drive shall provide provisions and terminations inside the drive enclosure for branch circuit protection of a separately

mounted isolation transformer or harmonic filter. The AC Drive disconnect shall serve as disconnect for the harmonic filters. Branch circuit protection shall be in accordance with the NEC using fused protection. Harmonic filters shall be isolated from bypass path operation if supplied.

2.17 HARMONIC ANALYSIS

Note to Specifier: Guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems", which suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers. Collectively, all facility loads and the building electrical distribution network determines the harmonic levels at the user & electric utility interface. The Electrical Power Research Institute (EPRI) recognizes the 'Point of Common Coupling' or PCC as the interface between user and electric utility (energy meter) in the electrical distribution network. The AC Drives manufacturer can provide calculations through computer modeling, specific to the installation, showing total harmonic voltage distortion. Contractor to provide one line diagram drawings to supplier including transformer impedance. The AC Drive manufacturer needs this information.

- a. A harmonic distortion analysis shall be performed and priced as a separate line item by the AC Drive manufacturer based upon documentation supplied by the contractor. The documentation shall consist of one-line diagrams, distribution transformer information (kVA, %Z, and X/R ratio) and emergency standby generator performance specifications. The harmonic distortion analysis report shall be part of the approval drawing process, submitted to the engineer for approval.
- b. If the calculations determine that harmonic distortion values are higher than the voltage and current values specified, the drive manufacturer shall provide [line reactors, isolation transformers, harmonic suppressors] to meet the intent of IEEE 519-1992 guidelines.

PART 3 EXECUTION

3.01 INSPECTION

- a. Verify that the location is ready to receive work and the dimensions are as indicated.
- a. Do not install AC Drive equipment until the building environment can be maintained within the service conditions required by the manufacturer.

3.02 PROTECTION

- a. Before and during the installation, the AC Drive equipment shall be protected from site contaminants and debris.

3.03 INSTALLATION

- a. Installation shall comply with manufacturer's instructions, drawings and recommendations.
- b. The AC Drive manufacturer shall provide a factory certified technical representative to supervise the contractor's installation, testing and start-up of the AC Drive(s) furnished under this specification for a maximum total of [1,2,3] days. The start-up service shall be quoted as a separate line item.

3.04 TRAINING

- a. An on-site training course of [1,2] training days shall be provided by a representative of the AC Drive manufacturer plant and/or maintenance personnel and quoted as a separate line item.

END OF SECTION

**Class 8839 58M Enclosed AC Drives
Specifications**

Class 8839 Econoflex™ AC Drives

Contents



Class 8839 Econoflex AC Drives

DESCRIPTION	PAGE
DRIVE SELECTION	186
STANDARD FEATURES	187
FACTORY MODIFICATIONS	188
COMPONENT LOCATIONS	191
CONTROLLER RATINGS	194
INPUT CURRENT RATINGS	195
TECHNICAL CHARACTERISTICS	197
DISSIPATED WATTS LOSS	198
DIMENSIONS AND WEIGHTS FOR TYPE 1 AND TYPE 12K ENCLOSURES	199
RECOMMENDED SPARE PARTS	201
CIRCUIT BREAKER LIST	202
APPLICATION INFORMATION	203
SAMPLE SPECIFICATIONS	206

STANDARD FEATURES

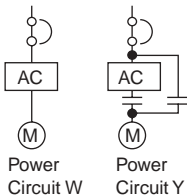
The Econoflex controller includes:

- Circuit breaker disconnect with lockout capability.
- Insulated Gate Bipolar Transistor (IGBT) power converter with PWM output waveform.
- Door-mounted keypad.
- Form C AFC fault contact, rated 2 A at 120 Vac, wired to customer terminal block.
- Form C AFC run contact, rated 2 A at 120 Vac, wired to customer terminal block.
- Fire/Freezestat interlock location provided to customer terminal block.
- Factory enclosed line reactor (25 to 100 HP at 460 Vac, 15 to 50 HP at 208/230 Vac).
- Top and bottom conduit knockouts for Type 1 and Type 12K.
- Industrial rated control operators.
- UL 508C listed with NEMA ICS 7.1 compliance.
- Instruction bulletin 30072-450-10.

When Bypass is selected the Econoflex controller also includes:

- Isolation and Bypass Contactors, mechanically and electrically interlocked.
- AFC-OFF-BYPASS Selector Switch.
- TEST-NORMAL Selector Switch.
- Class 20 overload protection.

Power Circuit Descriptions



PowerCircuitW&Y copy.eps

- Power Circuit W operates the motor from the power converter.
- Power Circuit Y operates the motor from the power converter or from full voltage line power, bypass. The isolation and bypass contactors are mechanically and electrically interlocked. The two contactor isolation/bypass configurations sequence the contactors to provide the isolation of the motor when it is not running.

Test-Normal Selector Switch Description

The Test-Normal selector switch is mounted on the door of the controller and supplied with the bypass circuit. The Test-Normal switch is used to test the power converter while operating the motor in bypass. To use this function and maintain motor operation, place the following switches in these positions:

- AFC-Off-Bypass: Set the switch to Bypass to run the motor at full speed across the line.
- Test-Normal: Set the switch to Test.
- Hand-Off-Auto: Set the switch to Hand. Use the manual speed potentiometer to change the speed reference and observe power converter operation.

Fire/Freezestat Interlock Description

User terminals are supplied for accepting a user supplied fire/freezestat interlock (normally closed). When the user supplied contact is opened the drive output isolation contactor and bypass contactor open and the motor stops.

Class 8839 Econoflex™ AC Drives Factory Modifications

FACTORY MODIFICATIONS

The tables below define the factory modifications.

Control Options

Mod	Door-mounted Controls
A07	<p>Hand-Off-Auto selector switch, Speed Potentiometer</p> <ul style="list-style-type: none"> <li>• Hand mode is for local control. <ul style="list-style-type: none"> <li>— In Bypass operation, as soon as Hand mode is selected, the motor will start with a full-voltage across the line start. <li>— In AFC operation, as soon as Hand mode is selected, the power converter starts the motor. The manual speed potentiometer is used to control the speed of the drive controller. <li>• Auto mode is for remote control. <ul style="list-style-type: none"> <li>— In Bypass operation, a full-voltage across-the-line start will occur when the user-supplied run contact is closed. <li>— In AFC operation, the power converter starts the motor when the user-supplied run contact is closed. Motor speed is varied by adjusting the user-supplied auto speed reference 4-20 mA signal or a 0-10 Vdc signal if Mod J09 is selected. <li>• Off commands the motor to stop. Set to the off position for fault reset.
B07	<p>Hand-Off-Auto selector switch, Start-Stop pushbuttons, Speed Potentiometer</p> <ul style="list-style-type: none"> <li>• Hand mode is for local control. <ul style="list-style-type: none"> <li>— In Bypass operation, when Hand mode is selected, the motor will start with a full-voltage across the line start when the start pushbutton is pressed. <li>— In AFC operation, when Hand mode is selected, the power converter starts the motor when the start pushbutton is pressed. The manual speed potentiometer is used to control the speed of the drive controller. <li>• Auto mode is for remote control. <ul style="list-style-type: none"> <li>— In Bypass operation, a full-voltage across-the-line start will occur when the user-supplied run contact is closed. <li>— In AFC operation, the power converter starts the motor when the user-supplied run contact is closed. Motor speed is varied by adjusting the user-supplied auto speed reference 4-20 mA signal or a 0-10 Vdc signal if Mod J09 is selected. <li>• Off commands the motor to stop. Set to the off position for fault reset. <li>• The start pushbutton starts the motor in Hand mode. <li>• The stop pushbutton stops the motor in Hand mode. The stop pushbutton is not active in the Auto mode.

Class 8839 Econoflex™ AC Drives Factory Modifications

FACTORY MODIFICATIONS (CONTINUED)

Control Options

C07	<p>Start-Stop pushbuttons, Speed Potentiometer</p> <ul style="list-style-type: none"> The start pushbutton commands the power converter to start the motor. The stop pushbutton stops the motor.
N07	<p>None</p> <p>This option omits factory door-mounted control operators and is for use with customer-supplied external control devices. Refer to the Econoflex instruction manual 30072-450-10_ for wiring equivalent to Mods A07, B07 and C07.</p>

Light Options

Mod	Door-mounted Light Cluster
A08	<p>Red power On, Green AFC Run, Yellow AFC Fault, Yellow Auto</p> <ul style="list-style-type: none"> Power On illuminates when mains power is applied to the controller. AFC Run illuminates to annunciate an AFC run condition. AFC Fault illuminates to annunciate an AFC fault condition. When a line contactor is selected, the light illuminates when the AFC-Off-Bypass switch is in the Off or Bypass position to indicate that the power converter is not running. Auto illuminates when the Hand-Off-Auto selector is in the Auto position.
B08	<p>Red power On, Green AFC Run, Yellow AFC Fault, Yellow Bypass</p> <ul style="list-style-type: none"> Power On illuminates when mains power is applied to the controller. AFC Run illuminates to annunciate an AFC run condition. AFC Fault illuminates to annunciate an AFC fault condition. When a line contactor is selected, the light illuminates when the AFC-Off-Bypass switch is in the Off or Bypass position to indicate that the power converter is not running. Bypass illuminates when the motor is started across the line. The light is sequenced by the Hand-Off-Auto selector switch.
C08	<p>Red power On, Green AFC Run, Yellow AFC Fault</p> <ul style="list-style-type: none"> Power On illuminates when mains power is applied to the controller. AFC Run illuminates to annunciate an AFC run condition. AFC Fault illuminates to annunciate an AFC fault condition.

Class 8839 Econoflex™ AC Drives Factory Modifications

FACTORY MODIFICATIONS (CONTINUED)

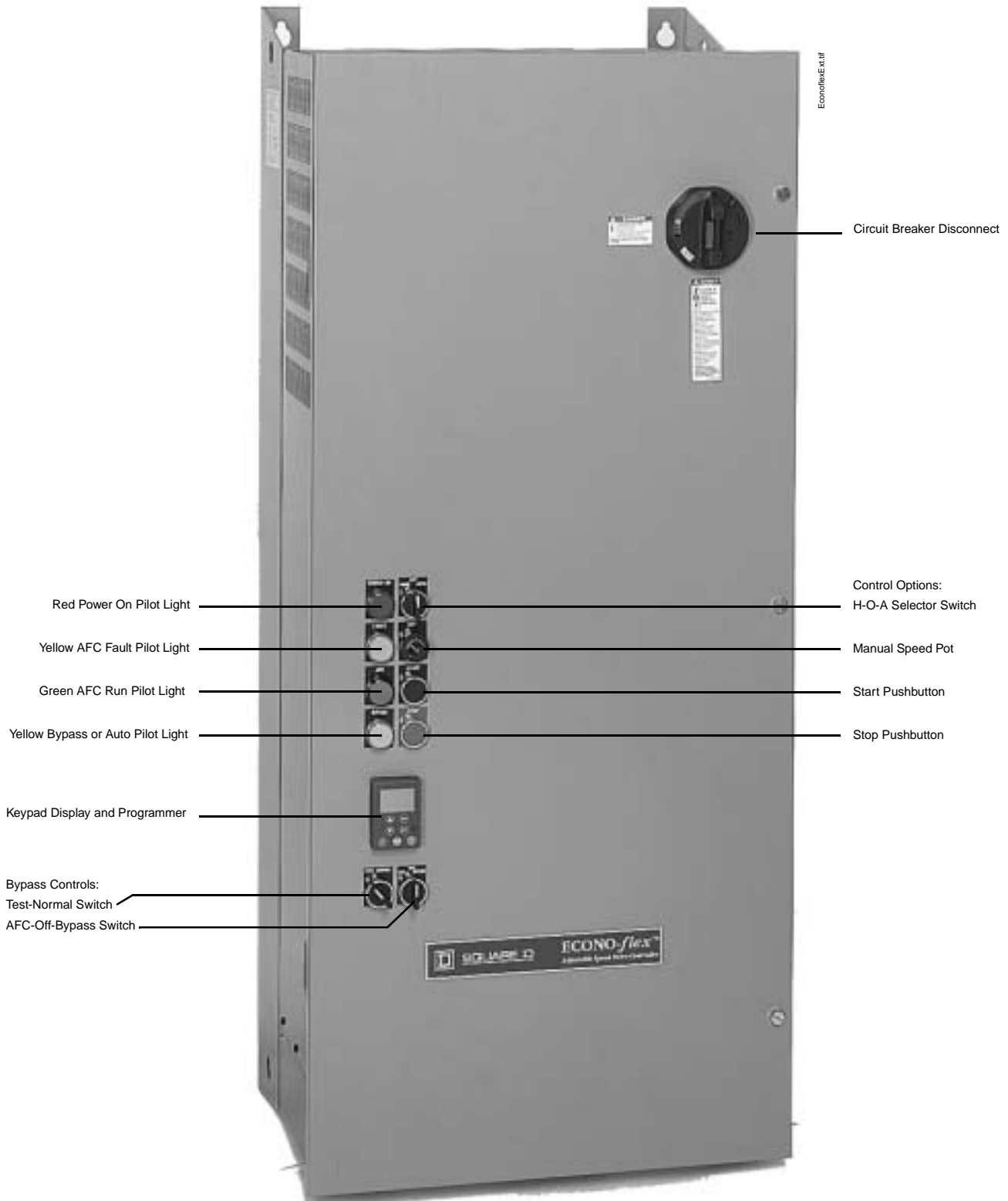
Miscellaneous Options

Mod	Description
A09	<p>Line Reactor</p> <p>Includes an integrally-mounted AC line reactor factory-installed and -wired between the circuit breaker disconnect means and the power converter for high-true power factor and effective harmonic mitigation. It complies with IEEE 519 guidelines. Optional for 1 to 20 HP 460 Vac and 1 to 10 HP 208/230 Vac models, but included for 25 to 100 HP 460 Vac and 15 to 50 HP 208/230 Vac models.</p>
B09	<p>Line Contactor</p> <p>Provides a line contactor factory-wired between the circuit breaker disconnect (or line reactor, when provided) and the power converter.</p>
C09	<p>3 to 15 PSI Transducer with Digital Display</p> <p>Provides the controller with the capability to follow a user supplied 3 to 15 PSI follower signal. The module is calibrated to operate as a 4-20 mA DC follower for the power converter.</p>
D09	<p>Omit Keypad Display</p> <p>Omits keypad display from the door of the controller. A separate keypad must be ordered to program the drive controller.</p>
E09	<p>Smoke Purge</p> <p>Provides smoke purge operating mode controlled by a user-supplied 120 Vac signal. When power is supplied to the user-supplied contact, motor operation is transferred to:</p> <ul style="list-style-type: none"> • 60 Hz operation if Power Circuit W is supplied. • Bypass across the line operation if Power Circuit Y is supplied.
G09	<p>22 kAIC UL Coordinated Rating</p> <p>Provides fully-coordinated 22 kAIC rating marked on the enclosure nameplate (short-circuit coordination to UL508C Power Conversion Equipment and NEMA ICS 7.1).</p>
H09	<p>Analog Card</p> <p>Provides an analog output with a range of 0-20 mA for customer use. It is factory-programmed for motor frequency, and includes an analog card with AO and COM wired to the customer terminal block. Reassignable X-Y range with keypad display.</p>
J09	<p>0-10 Vdc Auto Speed Reference</p> <p>Provides controller interface for 0-10 Vdc customer supplied auto speed reference signal into AI2 input using 0-10 V/ 4-20 mA converter with Z = 100 kΩ.</p>

Class 8839 Econoflex™ AC Drives Component Locations

COMPONENT LOCATIONS

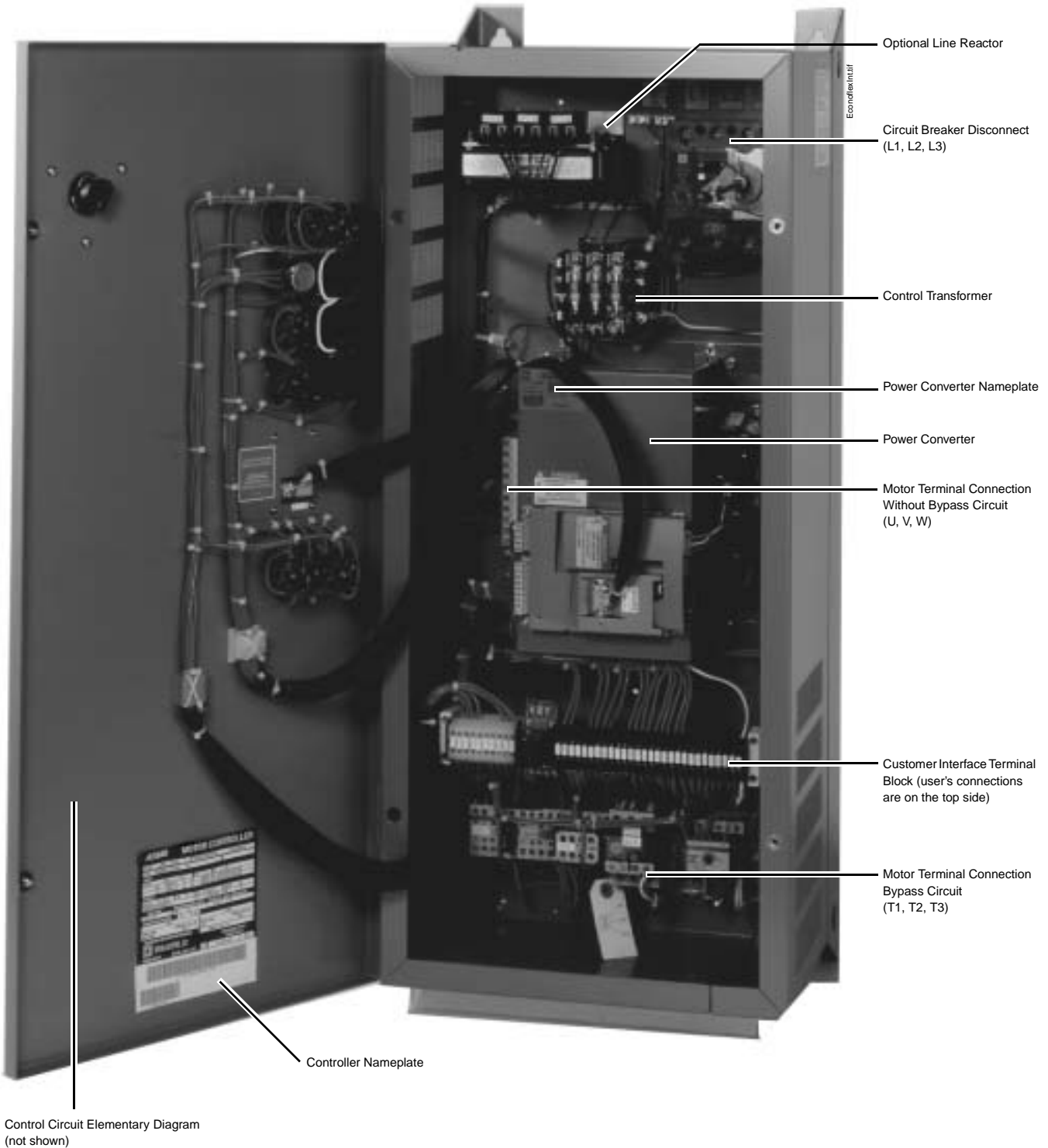
Front Component Locations for 1 to 100 HP 460 Vac and 1 to 50 HP 208/230 Vac Controllers
(Class 8839, 58EPG4VY, Mods B07, B08, A09, B09, and E09 Shown)



Class 8839 Econoflex™ AC Drives Component Locations

COMPONENT LOCATIONS (CONTINUED)

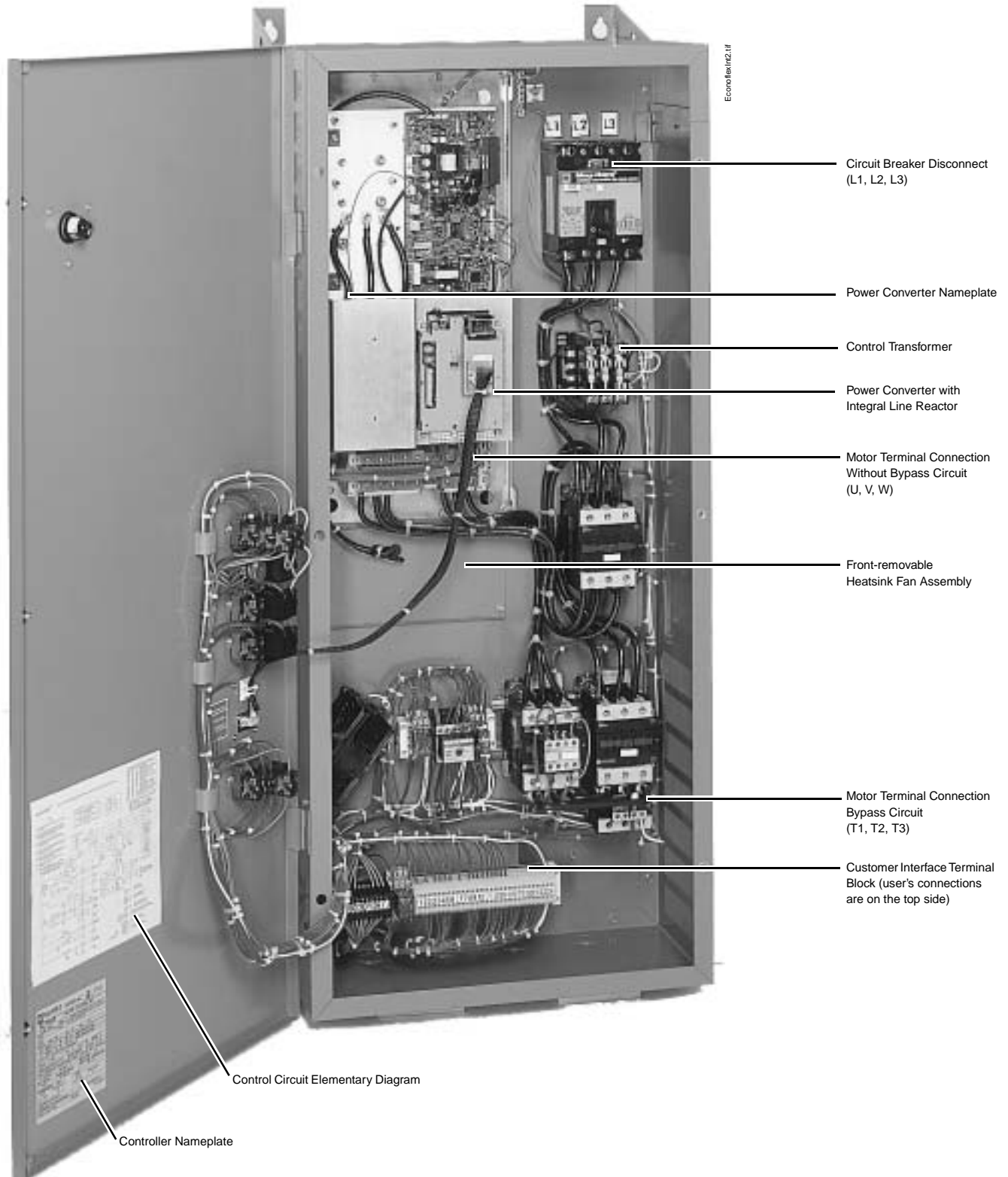
Inside Cabinet Component Locations for 1 to 20 HP 460 Vac and 1 to 10 HP 208/230 Vac Controllers
(Class 8839, 58EGG4VY, Mods B07, B08, A09, B09, and E09 Shown)



Class 8839 Econoflex™ AC Drives Component Locations

COMPONENT LOCATIONS (CONTINUED)

Inside Cabinet Component Locations for 25 to 100 HP 460 Vac and 15 to 50 HP 208/230 Vac Controllers
(Class 8839, 58EPG4VY, Mods B07, B08, A09, B09, and E09 Shown)



Class 8839 Econoflex™ AC Drives Ratings

CONTROLLER RATINGS

Class 8839 ATV58 Econoflex Drive Controller Ratings 460 Vac

Drive Controller Catalog Number♦	Motor Power [▲] 460 Vac 60 Hz (HP)	Maximum Continuous Output Current (A) [■]	Max. Transient (60 s) Output Current (A)	Power Converter Part Number
58EC•4V_	1	2.1	2.3	FLEX58U18N4
58ED•4V_	2	3.4	3.7	FLEX58U29N4
58EE•4V_	3	4.8	5.3	FLEX58U41N4
58EF•4V_	5	7.6	8.4	FLEX58U72N4
58EG•4V_	7.5	11	12.1	FLEX58U90N4
58EH•4V_	10	14	15.4	FLEX58D12N4
58EJ•4V_	15	21	23.1	FLEX58D16N4
58EK•4V_	20	27	29.7	FLEX58D23N4
58EL•4V_	25	34	37.4	FLEX58D28N4
58EM•4V_	30	40	44	FLEX58D28N4
58EN•4V_	40	52	57.2	FLEX58D33N4
58EP•4V_	50	65	71.5	FLEX58D46N4
58EQ•4V_	60	77	84.7	FLEX58D54N4
58ER•4V_	75	96	105.6	FLEX58D64N4
58ES•4V_	100	124	136.4	FLEX58D79N4

Class 8839 ATV58 Econoflex Drive Controller Ratings 230 Vac

Drive Controller Catalog Number♦	Motor Power [▲] 230 Vac 60 Hz (HP)	Maximum Continuous Output Current (A) [■]	Max. Transient (60 s) Output Current (A)	Power Converter Part Number
58EC•3V_	1	4.2	4.6	FLEX58U29M2
58ED•3V_	2	6.8	7.5	FLEX58U29M2
58EE•3V_	3	9.6	10.5	FLEX58U41M2
58EF•3V_	5	15.2	16.7	FLEX58U72M2
58EG•3V_	7.5	22	24.2	FLEX58U90M2
58EH•3V_	10	28	30.8	FLEX58D12M2
58EJ•3V_	15	42	46.2	FLEX58D16M2
58EK•3V_	20	54	59.4	FLEX58D16M2
58EL•3V_	25	68	74.8	FLEX58D23M2
58EM•3V_	30	80	88	FLEX58D28M2
58EN•3V_	40	104	114.4	FLEX58D33M2
58EP•3V_	50	130	143	FLEX58D46M2

- ♦ The • may be A or G; A denotes a Type 12K enclosure; G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.
- ▲ Power shown is for a carrier switching frequency of 8 kHz. For a switching frequency between 12 and 16 kHz, select the next largest size drive controller. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle), this is not necessary.
- Continuous output current based on NEC table 430-150. The Econoflex controller nameplate rating is per the NEC table, not the current value listed in the keypad lookup table.

Class 8839 Econoflex™ AC Drives Ratings

CONTROLLER RATINGS (CONTINUED)

Class 8839 ATV58 Econoflex Drive Controller Ratings 208 Vac

Drive Controller Catalog Number♦	Motor Power▲ 208 Vac 60 Hz (HP)	Maximum Continuous Output Current (A)■	Max. Transient (60 s) Output Current (A)	Power Converter Part Number
58EC*2V_	1	4.6	5.1	FLEX58U29M2
58ED*2V_	2	7.5	8.3	FLEX58U29M2
58EE*2V_	3	10.6	11.7	FLEX58U41M2
58EF*2V_	5	16.7	18.4	FLEX58U72M2
58EG*2V_	7.5	24.2	26.6	FLEX58U90M2
58EH*2V_	10	30.8	33.9	FLEX58D12M2
58EJ*2V_	15	46.2	50.8	FLEX58D16M2
58EK*2V_	20	59.4	65.3	FLEX58D16M2
58EL*2V_	25	74.8	82.3	FLEX58D23M2
58EM*2V_	30	88	96.8	FLEX58D28M2
58EN*2V_	40	114	125.4	FLEX58D33M2
58EP*2V_	50	143	157.3	FLEX58D46M2

- ♦ The • may be A or G; A denotes a Type 12K enclosure, G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.
- ▲ Power shown is for a carrier switching frequency of 8 kHz. For a switching frequency between 12 and 16 kHz, select the next largest size drive controller. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle), this is not necessary.
- Continuous output current based on NEC table 430-150. The Econoflex controller nameplate rating is per the NEC table, not the current value listed in the keypad lookup table.

INPUT CURRENT RATINGS

Input Line Currents for Selection of Branch Circuit Feeder for Class 8839 Econoflex 460 Vac▲

Drive Controller Catalog Number▼	Motor Power 460 Vac 60 Hz (HP)	5 kAIC (0.141 mH) 10 kAIC (0.070 mH) (A)	22 kAIC (0.032 mH) (A)	Factory-mounted Line Reactor■ Mod A09	
				5 kAIC (0.141 mH) 10 kAIC (0.070 mH) (A)	22 kAIC (0.032 mH) (A)
58EC*4V_	1	2.8	3.2	1.8	2
58ED*4V_	2	4.8	5.2	3.5	3.8
58EE*4V_	3	6.5	7.6	4.9	5.7
58EF*4V_	5	10.7	12.6	7.9	9.3
58EG*4V_	7.5	14.3	16.9	11.5	13.2
58EH*4V_	10	18.2	22	12.9	15.6
58EJ*4V_	15	25.3	30.3	22.9	22.9
58EK*4V_	20	32	38.4	25.2	30
58EL*4V_	25	32.7	34.1	32.7	34.1
58EM*4V_	30	38.1	39.8	38.1	39.8
58EN*4V_	40	49.3	51.6	49.3	51.6
58EP*4V_	50	61.8	65.4	61.8	65.4
58EQ*4V_	60	75.2♦	77.7	75.2♦	77.7
58ER*4V_	75	96.3♦	100.8	96.3♦	100.8
58ES*4V_	100	122.6♦	129.3	122.6♦	129.3

- ▲ Select conductor based on NEC.
- ▼ The • may be A or G; A denotes a Type 12K enclosure; G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.
- Factory modification A09 is optional for 1 to 20 HP controllers and included in 25 to 100 HP controllers.
- ♦ 10 kAIC.

Class 8839 Econoflex™ AC Drives Ratings

INPUT CURRENT RATINGS (CONTINUED)

Input Line Currents for Selection of Branch Circuit Feeder for Class 8839 Econoflex 230 Vac[▲]

Drive Controller Catalog Number [▼]	Motor Power 230 Vac 60 Hz (HP)	5 kAIC (0.141 mH) (A)	22 kAIC (0.032 mH) (A)	Factory-mounted Line Reactor [■] Mod A09	
				5 kAIC (0.141 mH) (A)	22 kAIC (0.032 mH) (A)
58EC•3V_	1	4.9	5.6	3.3	3.5
58ED•3V_	2	8.6	9.7	5.6	5.9
58EE•3V_	3	11.8	13.4	8.1	8.5
58EF•3V_	5	19.5	22.1	14.1	14.7
58EG•3V_	7.5	26.4	30	19.9	20.6
58EH•3V_	10	35	38.2	27.5	28.6
58EJ•3V_	15	37.8	38	37.8	38
58EK•3V_	20	50.5	50.8	50.5	50.8
58EL•3V_	25	61.8	61.8	61.8	61.8
58EM•3V_	30	73.3	73.6	73.3	73.6
58EN•3V_	40	97.9	98.5	97.9	98.5
58EP•3V_	50	121.2	124	121.2	124

Input Line Currents for Selection of Branch Circuit Feeder for Class 8839 Econoflex 208 Vac[▲]

Drive Controller Catalog Number [▼]	Motor Power 208 Vac 60 Hz (HP)	5 kAIC (0.141 mH) (A)	22 kAIC (0.032 mH) (A)	Factory-mounted Line Reactor [■] Mod A09	
				5 kAIC (0.141 mH) (A)	22 kAIC (0.032 mH) (A)
58EC•2V_	1	5.3	6	3.7	3.8
58ED•2V_	2	9.4	10.6	6.5	6.6
58EE•2V_	3	13	14.5	9.2	9.5
58EF•2V_	5	21.4	24	16.2	17.1
58EG•2V_	7.5	29	34.7	22.9	23.3
58EH•2V_	10	38.3	44.4	31.7	32.3
58EJ•2V_	15	41.7	41.7	41.7	41.7
58EK•2V_	20	55.5	55.7	55.5	55.7
58EL•2V_	25	67	67.2	67	67.2
58EM•2V_	30	80.9	80.9	80.9	80.9
58EN•2V_	40	107.6	108.4	107.6	108.4
58EP•2V_	50	134.8	135.5	134.8	135.5

- ▲ Select conductor based on the input line current.
- ▼ The • may be A or G; A denotes a Type 12K enclosure; G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.
- Factory modification A09 is optional for 1 to 20 HP controllers and included in 25 to 100 HP controllers.

Class 8839 Econoflex™ AC Drives

Technical Characteristics

TECHNICAL CHARACTERISTICS

Specifications for 460 Vac Drive Controllers

Input voltage	460 V \pm 10%, 230 V \pm 10%, 208 V \pm 10%
Displacement power factor	98% through speed range
Input frequency	60 Hz \pm 5%
Output voltage	Three-phase output Maximum voltage equal to input voltage
Galvanic isolation	Galvanic isolation between power and control (inputs, outputs, and power supplies)
Frequency range of power converter	0.1 to 500 Hz (factory setting of 60 Hz maximum)
Current	110% of controller rated current for 60 s
Switching frequency	Selectable from 0.5 to 16 kHz♦ Factory setting: 8 kHz
Speed reference	AI1: 0 to 10 V, Impedance = 30 k Ω Speed potentiometer to AI1. AI2: Factory Setting: 4 to 20 mA, Impedance = 100 Ω (re-assignable, X–Y range with keypad display) Factory Mod J09: provides controller interface 0-10 Vdc reference signal into AI2 input using 0-10 V/4-20 mA converter with Z= 100 k Ω .
Frequency resolution in analog reference	0.1 for 100 Hz (10 bits)
Speed regulation	V/f: determined by motor slip, typically 3% SLFV (sensorless flux vector): 1%
Efficiency	97% at full load typical
Reference sample time	5 ms
Acceleration and deceleration ramps	0.1 to 999.9 seconds (definition to 0.1 s increments)
Motor protection	Class 10 electronic overload protection Class 20 electromechanical overload protection with bypass▲
Keypad display	Self diagnostics with fault messages in three languages; also refer to Instruction Bulletin VVDED397047US
Temperature	Storage: -13 to +149 °F (-25 to +65 °C) Operation: +14 to +104 °F (-10 to 40 °C)
Humidity	95% with no condensation or dripping water, conforming to IEC 60068-2-3
Altitude	3,300 ft. (1000 m) maximum without derating; derating of the current by 1% for each additional 330 ft. (100 m)
Enclosure	Type 1 or Type 12K (Type 12 with knockouts)
Pollution degree	Type 1: Pollution degree 2 per NEMA ICS-1 Annex A and IEC 60664-1 Type 12K: Pollution degree 3 per NEMA ICS-1 Annex A and IEC 60664-1
Operational test vibration	Conforming to IEC 60721-3-3-3M3 amplitude 1.5 mm peak to peak from 3 to 13 Hz 1 g from 13 to 200 Hz
Transit test to shock	Conforming to National Safe Transit Association and International Safe Transit Association test for packages.
Operational shock	15 g, 11 ms
Codes and standards	UL Listed per UL508C under category NMMS. Conforms to applicable NEMA ICS, NFPA, and IEC Standards. Manufactured under ISO 9001 Standards.

- ♦ Above 8 kHz, select the next largest size drive controller. If the duty cycle does not exceed 60% (36 s maximum for a 60 s cycle), this is not necessary.
- ▲ Class 10 electromechanical for 1 HP at 460 Vac.

Class 8839 Econoflex™ AC Drives Dissipated Watts Loss

DISSIPATED WATTS LOSS

The total dissipated watts loss is provided for sizing the environment HVAC cooling requirements based upon worst-case conditions.

Total Dissipated Watts Loss for Econoflex 460 Vac Controllers

Drive Controller Catalog Number*	Horsepower	Total Dissipated Watts Loss
58EC*4V_	1	185
58ED*4V_	2	230
58EE*4V_	3	252
58EF*4V_	5	349
58EG*4V_	7.5	438
58EH*4V_	10	512
58EJ*4V_	15	643
58EK*4V_	20	766
58EL*4V_	25	853
58EM*4V_	30	975
58EN*4V_	40	1133
58EP*4V_	50	1251
58EQ*4V_	60	1318
58ER*4V_	75	1692
58ES*4V_	100	1972

Total Dissipated Watts Loss for Econoflex 230 Vac Controllers

Drive Controller Catalog Number*	Horsepower	Total Dissipated Watts Loss
58EC*3V_	1	237
58ED*3V_	2	298
58EE*3V_	3	380
58EF*3V_	5	406
58EG*3V_	7.5	510
58EH*3V_	10	732
58EJ*3V_	15	934
58EK*3V_	20	1098
58EL*3V_	25	1210
58EM*3V_	30	1258
58EN*3V_	40	1569
58EP*3V_	50	1899

Total Dissipated Watts Loss for Econoflex 208 Vac Controllers

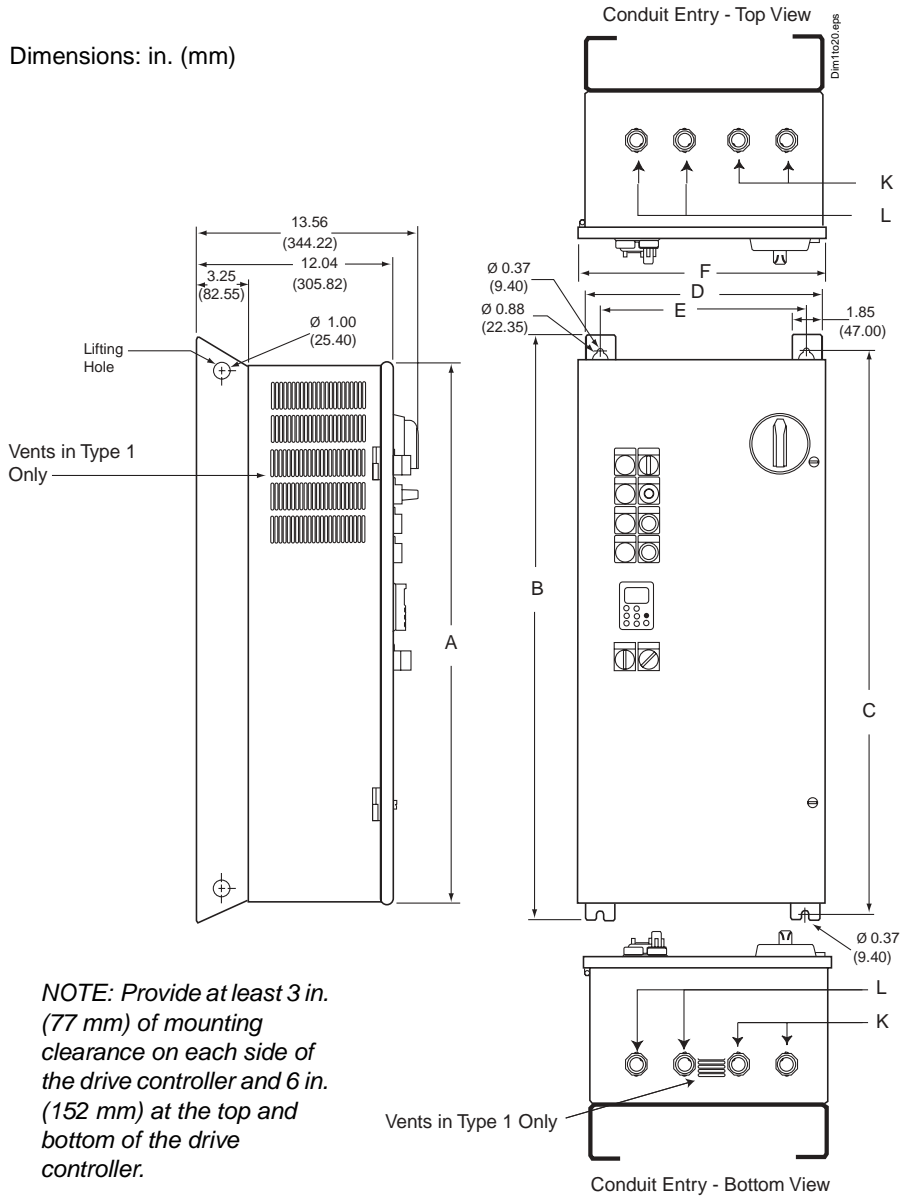
Drive Controller Catalog Number*	Horsepower	Total Dissipated Watts Loss
58EC*2V_	1	238
58ED*2V_	2	297
58EE*2V_	3	384
58EF*2V_	5	408
58EG*2V_	7.5	513
58EH*2V_	10	735
58EJ*2V_	15	939
58EK*2V_	20	1100
58EL*2V_	25	1213
58EM*2V_	30	1263
58EN*2V_	40	1580
58EP*2V_	50	1923

◆ The * may be A or G; A denotes a Type 12K enclosure; G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.

Class 8839 Econoflex™ AC Drives Dimensions and Weights

DIMENSIONS AND WEIGHTS FOR TYPE 1 AND TYPE 12K ENCLOSURES

Dimensions: in. (mm)



NOTE: Provide at least 3 in. (77 mm) of mounting clearance on each side of the drive controller and 6 in. (152 mm) at the top and bottom of the drive controller.

Knockout Dimensions

460 Vac	208/230 Vac	K	L
1 to 7.5 HP	1 to 5 HP	For 1/2" conduit	For 1/2" conduit
10 to 20 HP	7.5 to 10 HP	For 1/2", 3/4", and 1" conduit	For 1/2", 3/4", and 1" conduit

HP	HP	Weight		Enclosure Dimensions											
				A		B		C		D		E		F	
460 Vac	208/230 Vac	lb	kg	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
1 to 7.5	1 to 5	87	39.5	32.00	812.8	35.00	889.00	33.75	857.25	14.25	361.95	12.29	312.17	14.76	374.90
10 to 20	7.5 to 10	126	57.2	38.00	965.2	41.0	1041.40	39.75	1009.65	19.49	495.05	17.53	445.26	20.52	521.21

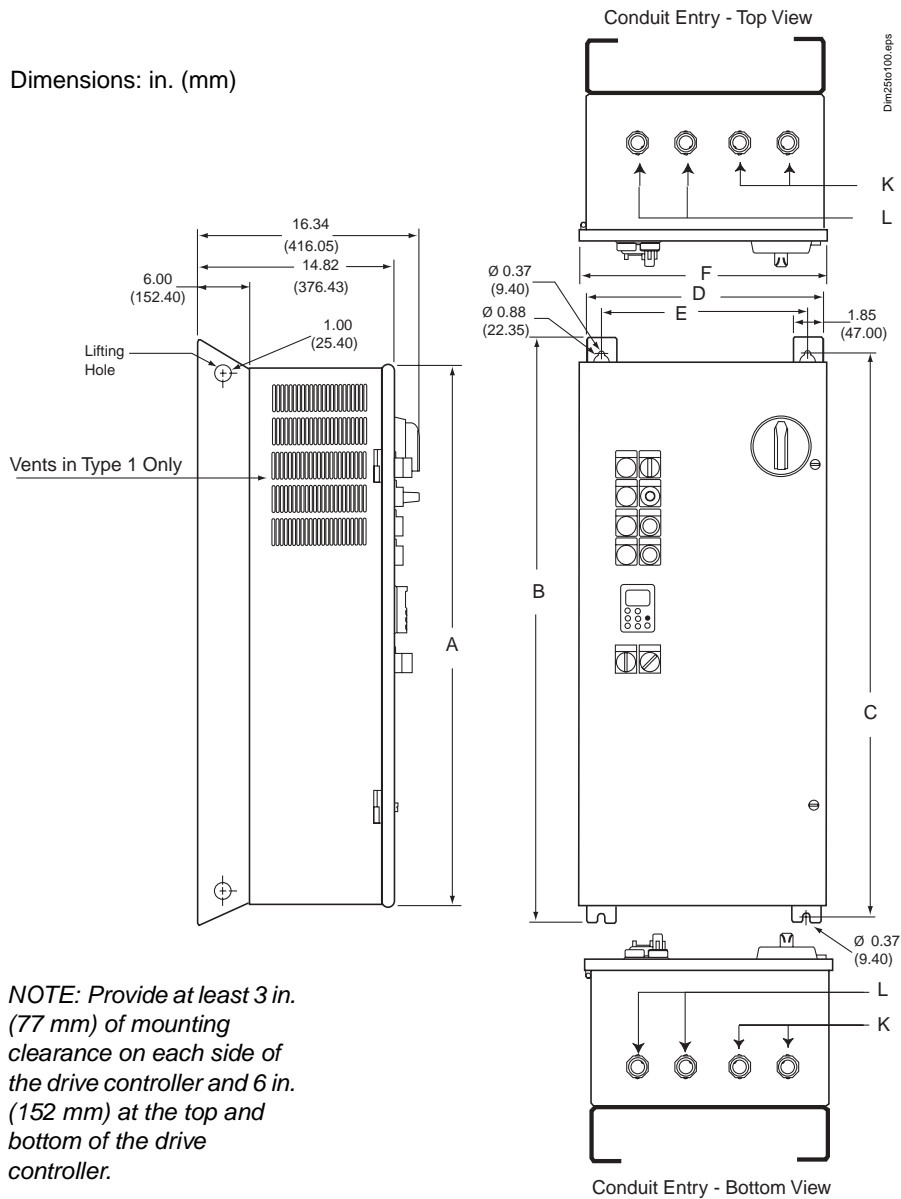
Mounting Information for 1 to 20 HP 460 Vac and 1 to 10 HP 208/230 Vac Controllers

Class 8839 Econoflex™ AC Drives

Dimensions and Weights

DIMENSIONS AND WEIGHTS FOR TYPE 1 AND TYPE 12K ENCLOSURES (CONTINUED)

Dimensions: in. (mm)



NOTE: Provide at least 3 in. (77 mm) of mounting clearance on each side of the drive controller and 6 in. (152 mm) at the top and bottom of the drive controller.

Knockout Dimensions

460 Vac		208/230 Vac		K	L
25 to 50 HP		15 to 25 HP		For 1-1/2", 2", and 2-1/2" conduit	For 1/2", 3/4", and 1" conduit
60 to 100 HP		30 to 50 HP		For 1-1/2", 2", and 2-1/2" conduit	For 1/2", 3/4", and 1" conduit

HP	HP	Weight		Enclosure Dimensions											
				A		B		C		D		E		F	
		lb	kg	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
25 to 50	15 to 25	180	81.60	46.00	1168.00	49.00	1244.60	47.83	1214.88	20.00	508.00	18.04	458.22	20.65	524.51
60 to 100	30 to 50	225	102.1	60.00	1524.00	63.00	1600.20	61.83	1570.48	25.00	635.00	23.05	585.47	25.65	651.51

Mounting Information for 25 to 100 HP 460 Vac and 15 to 50 HP 208/230 Vac Controllers

Class 8839 Econoflex™ AC Drives Recommended Spare Parts

RECOMMENDED SPARE PARTS

460 Vac Econoflex Models

Description	Qty	1 to 7.5 HP	Qty	10 to 20 HP	Qty	25 to 50 HP	Qty	60 to 100 HP
Power Converter♦	1	FLEX58U18N4 (1 HP) FLEX58U29N4 (2 HP) FLEX58U41N4 (3 HP) FLEX58U72N4 (5 HP) FLEX58U90N4 (7.5 HP)	1	FLEX58D12N4 (10 HP) FLEX58D16N4 (15 HP) FLEX58D23N4 (20 HP)	1	FLEX58D28N4 (25-30 HP) FLEX58D33N4 (40 HP) FLEX58D46N4 (50 HP)	1	FLEX58D54N4 (60 HP) FLEX58D64N4 (75 HP) FLEX58D79N4 (100 HP)
Keypad Display	1	VW3A58101U	1	VW3A58101U	1	VW3A58101U	1	VW3A58101U
Control Fuses Primary	2	25430-20050	2	25430-20050	2	25430-20050	2	25430-20050
Control Fuses Secondary	1	25430-20080	1	25430-20080	1	25430-20080	1	25430-20080
Pilot Light Red	1	ZB2BV04	1	ZB2BV04	1	ZB2BV04	1	ZB2BV04
Pilot Light Amber	1	ZB2BV05	1	ZB2BV05	1	ZB2BV05	1	ZB2BV05
Pilot Light Green	1	ZB2BV03	1	ZB2BV03	1	ZB2BV03	1	ZB2BV03
Light Module	1	ZB2BV3	1	ZB2BV3	1	ZB2BV3	1	ZB2BV3
Analog I/O Board■	1	VW3A58201U	1	VW3A58201U	1	VW3A58201U	1	VW3A58201U
Stirring Fan Assembly	1	N/A (Type 1) 31158-065-50 (Type 12K)	1	N/A (Type 1) 31158-065-50 (Type 12K)	1	N/A (Type 1) 31158-065-50 (Type 12K)	2	31158-065-50 (Type 12K)
Heatsink Fan Assembly	1	N/A	1	31158-067-50 (Type 1 & 12K)	1	31158-223-50 (Type 1 & 12K)	1	31158-240-50 (Type 1 & 12K)

208/230 Vac Econoflex Models

Description	Qty	1 to 5 HP	Qty	7.5 to 10 HP	Qty	15 to 25 HP	Qty	30 to 50 HP
Power Converter♦	1	FLEX58U29M2 (1-2 HP) FLEX58U41M2 (3 HP) FLEX58U72M2 (5 HP)	1	FLEX58U90M2 (7.5 HP) FLEX58D12M2 (10 HP)	1	FLEX58D16M2 (15-20 HP) FLEX58D23M2 (25 HP)	1	FLEX58D28M2 (30 HP) FLEX58D33M2 (40 HP) FLEX58D46M2 (50 HP)
Keypad Display	1	VW3A58101U	1	VW3A58101U	1	VW3A58101U	1	VW3A58101U
Control Fuses Primary	2	25430-20126	2	25430-20126	2	25430-20126	2	25430-20126
Control Fuses Secondary	1	25430-20080	1	25430-20080	1	25430-20080	1	25430-20080
Pilot Light Red	1	ZB2BV04	1	ZB2BV04	1	ZB2BV04	1	ZB2BV04
Pilot Light Amber	1	ZB2BV05	1	ZB2BV05	1	ZB2BV05	1	ZB2BV05
Pilot Light Green	1	ZB2BV03	1	ZB2BV03	1	ZB2BV03	1	ZB2BV03
Light Module	1	ZB2BV3	1	ZB2BV3	1	ZB2BV3	1	ZB2BV3
Analog I/O Board■	1	VW3A58201U	1	VW3A58201U	1	VW3A58201U	1	VW3A58201U
Stirring Fan Assembly	1	N/A (Type 1) 31158-065-50 (Type 12K)	1	31158-065-50 (Type1 & 12K)	1	31158-065-50 (Type 1 & Type 12K) 31158-295-50 (Type 12 K)	2	31158-065-50 (Type 1 & 12K)
Heatsink Fan Assembly	1	N/A (Type 1 & 12K)	1	31158-067-50	1	31158-223-50 (Type 1 & 12K)	1	31158-240-50 (Type 1 & 12K)

♦ The FLEX58 Power Converter is for use with Square D integrated Drive products only.

■ Field replacement of option board will reset the power converter to the Material Handling Macro. User must configure controller per elementary diagram with or without bypass shown in the Econoflex instruction bulletin, 30072-450-10.

Class 8839 Econoflex™ AC Drives Circuit Breaker List

CIRCUIT BREAKER LIST

8839 Controller▼	Horsepower	Circuit Breaker
460 V		
58EC•4V_	1	GJL36007M02
58ED•4V_	2	GJL36007M02
58EE•4V_	3	GJL36015M03
58EF•4V_	5	GJL36030M04
58EG•4V_	7.5	GJL36030M04
58EH•4V_	10	GJL36030M04
58EJ•4V_	15	GJL36050M05
58EK•4V_	20	GJL36050M05
58EL•4V_	25	GJL36050M05
58EM•4V_	30	GJL36075M06
58EN•4V_	40	FAL36100-18M
58EP•4V_	50	FAL36100-18M
58EQ•4V_	60	KAL36250-25M
58ER•4V_	75	KAL36250-26M
58ES•4V_	100	FAL36250-29M
230 V		
58EC•3V_	1	GJL36015M03
58ED•3V_	2	GJL36015M03
58EE•3V_	3	GJL36030M04
58EF•3V_	5	GJL36050M05
58EG•3V_	7.5	GJL36050M05
58EH•3V_	10	GJL36075M06
58EJ•3V_	15	GJL36075M06
58EK•3V_	20	GJL36075M06
58EL•3V_	25	FAL36100-18M
58EM•3V_	30	KAL36250-25M
58EN•3V_	40	KAL36250-26M
58EP•3V_	50	FAL36250-29M
208 V		
58EC•2V_	1	GJL36015M03
58ED•2V_	2	GJL36030M04
58EE•2V_	3	GJL36030M04
58EF•2V_	5	GJL36050M05
58EG•2V_	7.5	GJL36050M05
58EH•2V_	10	GJL36075M06
58EJ•2V_	15	GJL36075M06
58EK•2V_	20	FAL36100-18M
58EL•2V_	25	FAL36100-18M
58EM•2V_	30	KAL36250-25M
58EN•2V_	40	KAL36250-26M
58EP•2V_	50	FAL36250-30M

▼ The • may be A or G; A denotes a Type 12K enclosure; G denotes a Type 1 enclosure. The underscore (_) indicates that the catalog number continues. See page 186 for detailed description of catalog numbers.

APPLICATION INFORMATION

When selecting and applying AC Drives, consider the following:

- AC drive selection
- Ambient temperature/altitude
- AC line and motor voltage
- Power factor
- Harmonics
- Input currents, with and without line reactors
- Drive isolation transformer
- Speed range and regulation
- Accelerating torque
- Follower signals
- Bypass operation
- Enclosure type
- Motor selection

AC Drive Selection

The Econoflex AC Drive Controller is selected based on the connected motor full load current. The Econoflex is listed by horsepower, voltage and maximum continuous output current rating that align to the latest NEC ratings. The motor horsepower rating may be used to select the Drive Controller, provided that the full load current does not exceed the maximum continuous output current rating of the Econoflex. When the motor full load current does exceed the maximum continuous output rating of the drive controller, select the next highest drive controller.

In multi-motor applications, the sum of the motor full load current, not horsepower must be used to select the appropriate AC Drive.

Ambient Temperature/Altitude

Storage Temperatures for the Econoflex range from –25 to 65 °C (–13 to 149 °F).

The Econoflex Drive Controller is rated to operate in an ambient temperature of –10 to 40 °C (+14 to 104 °F). When ambient temperatures exceed 40 °C (104 °F), the drive controller and motor must be derated. For installations that require a higher operating ambient, derate by one horsepower size to a maximum of 50 °C (122 °F).

The Econoflex is rated for up to 3300 ft (1000 m) altitude without derating. Above these ratings, derate current by 1% for each additional 330 ft (100 m). For conditions where altitude exceeds 6600 ft (2000 m), special considerations apply. Environment, application, loading and ambient operating conditions could extend altitude range.

AC Line & Motor Voltage

The Econoflex Drive Controller is designed for operation under continuous rated input power from 208 V, 230 V and 460 V line voltages $\pm 10\%$ at 60 Hz.

Power Factor

The Econoflex Drive Controller uses diode bridge rectifiers that converts the fixed voltage and frequency from the AC line to a fixed DC bus voltage. Operation of the rectifiers does not cause any additional displacement between the voltage and current on the AC line feeding the Drive Controller.

This means that the displacement power factor (power factor measured by the utility) will not be degraded. Therefore, the AC drive power factor is rated 0.98 or better (lagging) at all times.

APPLICATION INFORMATION (CONTINUED)

Harmonics

Any device that uses a switching power device will produce a non-linear load and harmonics. The suggested guidelines for voltage and current distortion are addressed in IEEE Standard 519-1992 titled "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems." IEEE 519-1992 suggests distortion limits dependent upon the electric power distribution system for industrial and commercial consumers.

Collectively, all factory loads and the building electrical distribution network determines the harmonic levels at the user and electric utility interface. Commonly misapplied, the Electrical Power Research Institute (EPRI) recognizes the interface between user and electric utility (energy meter) in the electrical distribution network. This position is also supported in the Application Guide (P519A) prepared by the Harmonics Working Group of IEEE. Square D Company will typically provide line reactors or drive isolation transformers as the most cost effective method of harmonic abatement.

There are alternative methods of harmonic abatement that can be supplied such as 18 pulse and Mirus Lineator™ suppressors, not included within this catalog.

Input Current Ratings

Square D publishes input currents based on distribution system impedance at various available fault current ratings. Our literature reflects multiple input current ratings based on available fault currents.

- 5,000 AIC (1 to 50 HP @ 208/230/460 V)
- 10,000 AIC (60 to 100 HP @ 460 V)
- 22,000 AIC (1 to 100 HP @ 460 V and 1 to 50 HP @ 208/230 V when Mod G09 is selected)

Line reactors are provided with the majority of AC drives today. Line reactors are included in the Econoflex for 25 to 100 HP at 460 Vac and 15 to 50 HP at 208/230 Vac. Select Mod A09 to include a factory-enclosed reactor for 1 to 20 HP at 460 Vac and 1 to 10 HP at 208/230 V.

The use of line reactance ahead of the AC drive will:

- Reduce line current harmonic injection into the primary source.
- Limit the total harmonic voltage distortion from the AC drive at the point of common coupling to align with IEEE 519.
- Lower the available feeder short circuit capacity.
- Meet specified line impedance requirements.
- Prevent AC drive nuisance tripping due to transient overvoltages from power factor correction capacitor switching.
- All branch circuit components and equipment must be rated for the input current of the drive controller or the rated output current whichever value is larger.

Drive Isolation Transformer

Square D does not suggest the use of a drive isolation transformer unless the system requires one or more of items listed below. In addition to the functional comparison of a line reactor, drive transformers are normally used for one of the following reasons:

- Match system voltage to drive rating.
- Meet local or plant codes that require isolation.
- Capable of correcting line voltage unbalance conditions commonly seen with open delta and corner grounded delta distribution systems.
- Provides continuity of service for nuisance grounding.
- Reduces drive induced current in supply feeder ground and limit ground fault currents.
- Isolate the electrical common mode noise generated in solid state controllers from the distribution system.

APPLICATION INFORMATION (CONTINUED)

Speed Range and Regulation

The Econoflex Drive Controller operates within the range of 0.1 to 500 Hz. Factory setting is at 60 Hz. Please note, if operating motor above base speed, the motor manufacturer must approve this type of operation.

Accelerating Torque

AC induction motors built to NEMA standards are designed to provide starting torque which must meet certain minimum ratings. This is normally expressed as a percentage of full load torque. These torque ratings are valid only for full voltage starting where inrush current can be approximately 600% of motor full load current. The Econoflex Drive Controller will limit starting current to a value usually not more than 110% (Variable Torque rated) of drive full load current, which provides approximately 110% starting torque for VT loads.

AC Drives provide better torque per ampere than any other reduced current method, but the starting torque available may be less than the starting torque available with an across-the-line starter. Applications with known high starting torque requirements should be carefully evaluated. It may be necessary to oversize the drive controller or the motor to provide the necessary accelerating torque.

Follower Signals

The Econoflex Drive Controller is designed to accept either a 4 to 20 mA_{dc} or 3 to 15 PSI (Mod C09) or 0-10 V_{dc} (Mod J09) signal.

Bypass Operation

Although the Econoflex is designed for maximum reliability, it is possible that a controller could be out of service when required to operate. Critical operations which can tolerate little or no down time should be considered for a bypass (full speed) circuit.

The bypass circuit consists of an isolation contactor and bypass contactor mechanically and electrically isolated. The isolation contactor disconnects the motor from the power converter. The Bypass contactor closes and operates the motor across-the-line.

Enclosure Types

The Econoflex Drive Controller is available in a Type 1 or Type 12 K enclosure. Type 12 K is a Type 12 with conduit knockouts.

Motor Selection

Econoflex Drive Controllers are designed to operate with any three phase AC squirrel cage induction motor or synchronous reluctance motor having voltage and current rating compatible with the Drive Controller.

The motor should meet NEMA MG1, Part 31 standards. The Part 31 standard calls for 1600 Volt rated magnet wire, while the Part 30 standard calls for 1000 Volt rated magnet wire. The higher voltage rated magnet wire will protect against possible premature motor failures due to voltage stress from fast dv/dt rise times commonly seen with IGBT based AC Drives.

Class 8839 Econoflex™ AC Drives

Sample Specifications

SPECIFICATIONS FOR CENTRIFUGAL PUMP AND FAN APPLICATIONS CLASS 8839 ECONOFLEX™ AC DRIVES

NOTE: These specifications apply to Enclosed Adjustable Frequency Drive Controllers, herein referred to as AC Drives. The Power Converter is a component of the AC Drive. To ensure project compatibility, these specifications follow the Construction Specifications Institute (CSI) format. Copies of this specification are available from Square D Company on the web site squared.com. Application information directly affects the type and rating of AC Drive that will be quoted. Brackets [] are provided where such data should be included. Please call your local Square D distributor or sales representative for specification assistance regarding a particular application. The AC Drive specification should be included in Division 16, Electrical, for proper coordination with the electrical distribution system.

PART 1: GENERAL

1.01 Scope of Work

- A. This section provides specification requirements for adjustable frequency drives and variable speed drives, herein referred to as AC Drives, for use with [NEMA B] [NEMA E] design AC motors.
- B. The AC Drive manufacturer shall furnish, field test, adjust, and certify all installed AC Drives for satisfactory operation.
- C. Any exceptions/deviations to this specification shall be indicated in writing and submitted with the quotation.

1.02 References

- A. ANSI/NFPA 70 - National Electrical Code.
- B. ANSI C84.1 - Voltages Tolerances for North America.
- C. IEC 60068 Part 2-3 - Basic Environmental Testing Procedures Part 2: Tests - Test Ca: Damp Heat.
- D. IEC 60146.1 - Semiconductor Converters - General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements.
- E. IEC 60664-1 - Insulation Coordination for Equipment Within Low-Voltage Systems.
- F. IEC 60447 - Man-Machine Interface Actuating Principles.
- G. IEC 60439-1 - Low Voltage Switchgear and Control gear Assemblies.
- H. IEC 60947-1 - Low Voltage Switchgear and Control gear Components.
- I. IEC 60364-1 - Electrical Installation of Buildings.
- J. IEC 60204-1/NFPA 79 - Electrical Equipment of Industrial Machines/Industrial Machinery.
- K. IEC 60106 - Guide for Specifying Environmental Conditions for Equipment Performance Rating.
- L. IEC 60529 - Degrees of Protection Provided by Enclosure.
- M. IEC 61000 - Electromagnetic Compatibility.
- N. IEC 60721 - Classification of Environmental Conditions.
- O. IEC 60255-8 Overload Relays.
- P. IEC 60801-2,-3,-4,-5 - Immunity Tests.
- Q. NEMA ICS 6 - Industrial Control and Systems Enclosures.
- R. NEMA ICS, Part 4 - Overload Relays.
- S. NEMA Publication 250 - Enclosures for Electrical Equipment.
- T. NEMA ICS 2-321 - Electrical Interlocks.
- U. NEMA ICS7 - Industrial Control and Systems Adjustable Speed Drives.
- V. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives.
- W. UL 50 - UL Standard for Safety Enclosures for Electrical Equipment.
- X. UL 98 - UL Standard for Disconnect Switches.
- Y. UL 507 - UL Standard for Safety Electric Fans.
- Z. UL 508 - UL Standard for Safety Industrial Control Equipment.

Class 8839 Econoflex™ AC Drives Sample Specifications

- AA. UL 508C - UL Standard for Safety Power Conversion Equipment.
- AB. UL 991 - UL Standard for Safety Tests for Safety Related Controls employing Solid-State Devices.
- AC. OSHA 1910.95 - AC Drive Controller Acoustical Noise.
- AD. Conforming to National Safe Transmit Association and International Safe Transmit Association Test for Packages Weighing 1 to 100 lbs. or Over.

1.03 Submittals

- A. [6] submittal packages including drawings shall be furnished for Engineers approval prior to factory assembly of the AC Drives. These packages shall consist of elementary power and control wiring diagrams on one drawing and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights shown, conduit entrance locations. Standard catalog specification sheets showing voltage, horsepower and maximum current ratings shall be furnished as part of the submittal package.

1.04 Warranty

- A. An 18-month on-site parts warranty shall be provided on materials and workmanship from the date of purchase.

1.05 Quality Assurance

- A. The manufacturer of the AC Drive shall be a certified ISO 9002 1994 facility.
- B. The AC Drive and all associated optional equipment shall be UL Listed according to UL 508 C — Power Conversion Equipment. As verification, a UL label shall be attached on the inside nameplate of the combination enclosure.
- C. The AC Drive shall be designed, constructed and tested in accordance with NEMA, NEC, and IEC standards.
- D. Every power converter shall be tested with an AC induction motor while loaded and temperature cycled within an environment chamber at 40 °C (104 °F).
- E. All pilot devices shall be industrial rated and tested to verify proper operation.

PART 2: PRODUCT

2.01 Manufacturers

- A. The AC Drive shall be provided by Square D Company, Class 8839, Econoflex, or prior approved equal. Substitutions must be submitted in writing three (3) weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.
- B. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

2.02 General Description

- A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage, as defined in the following sections.
- B. The input power section shall utilize a full-wave bridge design incorporating diode rectifiers. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line.
- C. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize intelligent power modules (IPMs), as required by the current rating of the motor.

2.03 Construction

- A. The AC Drive power converter shall be enclosed in a [Type 1, Type 12 K] enclosure with top and bottom conduit knockouts with a circuit breaker disconnect, industrial rated operator controls, user terminal strip connections and bypass controls [if required].
- B. The enclosure shall provide dedicated user terminals for power and control device connection.

Class 8839 Econoflex™ AC Drives

Sample Specifications

- C. Provisions shall be included for locking the disconnect in the OFF position with a padlock.
- D. All enclosure and heatsink fans shall be front accessible and not require the removal of the AC drive power converter.

2.04 Motor Data

- A. The AC Drive shall be sized to operate the following AC motor:
 - Motor horsepower []
 - Motor full load ampere []
 - Motor rpm will be [3600] [1800] [1200] [900] at 60 Hz.
 - Motor voltage will be [208] [230] [460]
 - Motor service factor will be [1.15] [1.25]
 - NEMA MG1 [Part 30] [Part 31]

2.05 Application Data

- A. The AC Drive shall be sized to operate a Variable Torque load.
- B. The speed range shall be from a minimum speed of 1.0 Hz to a maximum speed of 60 Hz.

2.06 Environmental Ratings

- A. The AC Drive shall meet IEC 60664-1 and NEMA ICS 1 Annex A Standards.
- B. The AC Drive shall be designed to operate in an ambient temperature from 0 °C to 40 °C (32 °F to 104 °F).
- C. The storage temperature range shall be –25 °C to 65 °C (–13 °F to 149 °F).
- D. The maximum relative humidity shall be 95% at 40 °C (104 °F), non-condensing.
- E. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 ft (1000 m). For altitudes above 3,300 ft (1,000 m), de-rate the AC Drive by 1% for every 330 ft (100 m).
- F. The AC Drive shall meet the IEC 60721-3-3-3M3 operational vibration specification.

2.07 Ratings

- A. The AC Drive shall be designed to operate from an input voltage of [460 Vac (±) 10%] [230 Vac (±) 10%] [208 Vac (±) 10%].
- B. The AC Drive shall operate from an input frequency range of 60 (±) 5%
- C. The displacement power factor shall not be less than 0.98 lagging under any speed or load condition.
- D. The efficiency of the AC Drive at 100% speed and load shall not be less than 97%.
- E. The variable torque rated AC Drive over current capacity shall be not less than 110% for 1 minute.
- F. The output carrier frequency of the AC Drive shall be programmable at 0.5, 1, 2, 4 or 8, kHz. In addition, the output carrier frequency shall be randomly modulated about the selected frequency.

2.08 Protection

- A. Upon power-up, the AC drive shall automatically test for valid operation of memory, loss of analog reference input, loss of communication, DC-to-DC power supply, control power, and pre-charge circuit.
- B. The enclosure shall provide a fully coordinated [5 kAIC] [10 kAIC] [22 kAIC] rating marked on the enclosure nameplate. Short circuit coordination to UL508C Power Conversion Equipment and NEMA ICS 7.1.
- C. The AC Drive shall be protected against short circuits, between output phases and to ground.
- D. The AC Drive shall have a minimum AC undervoltage power loss ride-through of 200 milliseconds (12 cycles).
- E. The AC drive shall have a programmable ride through function, which will allow the logic to maintain control for a minimum of one second (60 cycles) without faulting.

- F. For a fault condition other than a ground fault, short circuit or internal fault, an auto restart function will provide up to 6 programmable restart attempts. The time delay before restart attempts will be 30 seconds.
- G. Upon loss of the analog process follower reference signal, the AC Drive shall be programmable to display a fault.
- H. The AC Drive shall have a solid-state UL 508 C listed overload protective device and meet IEC 60947.
- I. The output frequency shall be software enabled to fold back when the motor is overloaded.

2.09 Adjustments and Configurations

- A. The AC Drive will be factory programmed to operate all specified optional devices.
- B. The acceleration and deceleration ramp times shall be adjustable from 0.05 to 999.9 seconds.
- C. The memory shall retain and record run status and fault type of the past 8 faults.
- D. The software shall have a Energy Economy function that, when selected, will reduce the voltage to the motor when selected for variable torque loads. A constant V/Hz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.

2.10 Keypad Display Interface

- A. The keypad display interface shall offer the modification of AC Drive adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, and adjustment storage, and diagnostics shall be in plain English. There will be a standard selection of 4 additional languages built-in to the operating software as standard.
- B. The display will be a high resolution, LCD back-lit screen.
- C. The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency and motor voltage shall be listed on the drive identification portion of the LCD display.
- D. The keypad display shall consist of programmable function keys that allow both operating commands and programming options to be preset by the operator. A hardware selector switch shall allow the terminal keypad to be locked out from unauthorized personnel.

2.11 Operator Controls

- A. The control power for the digital inputs and outputs shall be 24 Vdc.
- B. The internal power supply shall incorporate automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs will be current limited and will not be damaged if shorted.
- C. Pull-apart terminal strips shall be used on all logic and analog signal connections in the power converter.
- D. Two voltage-free relay output contacts will be provided. One of the contacts will indicate AC Drive fault status. The other contact shall indicate a drive run status.
- E. The Drive Controller enclosure shall have the following dedicated operator controls as required for the application:
 - Hand-Off-Auto switch [Start-Stop pushbutton and Hand-off-Auto switch] [Start-Stop pushbutton]
 - Manual Speed Potentiometer
 - AFC-Off-Bypass switch
 - Test-Normal Selector switch
 - Power On (red) LED indicator
 - Drive Run (green) LED indicator
 - Drive Fault (yellow) LED indicator
 - Auto Mode (yellow) or Bypass Run (yellow) LED indicator

Class 8839 Econoflex™ AC Drives

Sample Specifications

- F. The combination enclosure shall include a 120 Vac smoke purge relay option [if required]. A user-supplied 120 Vac signal shall be sequenced in accordance with local fire protection codes and will switch the AC drive to 60 Hz operation for maximum fan motor speed. If drive bypass is supplied, the smoke purge relay will isolate the AC Drive and run the fan motor full speed on bypass.
- G. The combination enclosure shall include terminal point connection for fire /freeze stat interlock, to prevent drive [or bypass] operation.

2.12 Drive Isolation & Bypass Contactors

- A. The AC Drive shall include mechanically and electrically interlocked isolation and bypass contactors complete with Class 20 thermal overload relay, circuit breaker disconnect, control circuit transformer, AFC/OFF/BYPASS switch and TEST/NORMAL selector switch.
- B. The operator shall have full control of the bypass starter by operation of the AFC/OFF/BYPASS selector switch.
- C. In the AUTOMATIC mode of operation the bypass contactors shall be sequenced by the 110-volt rated auto start contact provided by the user.
- D. The isolation contactor for the bypass shall be sequenced to provide motor isolation during a drive ready state of operation.
- E. A TEST/NORMAL selector switch shall provide test operation of the power converter while operating the motor in bypass.

2.13 Harmonic Mitigation

- A. The electrical distribution system has been designed to meet IEEE-519-1992 with the addition of line reactors. These line reactors shall be mounted inside the drive enclosure.

PART 3: EXECUTION

The Enclosed AC Drive shall be Econoflex™ by Square D Company, Class 8839.

3.01 Inspection

- A. Verify that the location is ready to receive work and the dimensions are as indicated.

3.02 Protection

- A. Before and during the installation, the AC Drive equipment shall be protected from site contaminants.

3.03 Installation

- A. Installation shall be in compliance with manufacturer's instructions, drawings and recommendations.
- B. The AC Drive manufacturer shall provide a factory certified technical representative to inspect the contractor's installation, test and start-up the AC Drive(s) furnished under this specification for a maximum total of [] days. The start-up service shall be quoted as a separate line item.

3.04 Training

- A. An on-site training course of [] training days shall be provided by a representative of the AC Drive manufacturer to plant and/or maintenance personnel.

3.05 Documentation

- A. The AC Drive manufacturer shall supply a comprehensive 8-1/2" x 11" bound instruction/installation manual that includes wiring diagrams, layout diagrams, and outline dimensions. This manual must be 3-hole punched for insertion in a shop manual supplied by the installing contractor.

Class 8998 Motor Control Centers Contents



8998_Altivar_58_MCCs_2003.tif

Class 8998 Motor Control Centers

DESCRIPTION	PAGE
GENERAL INFORMATION	212
MCC PACKAGE FEATURES	212
FACTORY OPTIONS	213
MONITORING AND INDICATION	213
AC DRIVE OPTIONS	214
BASIC "DRIVE" POWER CIRCUIT	214
SPACE REQUIREMENTS	215
POWER CONTACTOR OPTIONS	217
PILOT DEVICES	218
MISCELLANEOUS OPTIONS	218
MULTI-DRIVE PROCESS LINE CABINETS	220
WIRING DIAGRAMS	221
SAMPLE SPECIFICATIONS.....	223

Class 8998 Motor Control Centers

General Information and MCC Package Features

GENERAL INFORMATION

The Altivar® 58 TRX AC Drive in Motor Control Centers (MCCs) offers an economical, general purpose drive in a high density, space saving package. Units are available in NEMA Type 1, Type 1 with gaskets, and Type 12 (for drives less than 125 hp) MCC enclosures in the following ranges:

Motor Ratings	Variable Torque Applications	Constant Torque Applications	Variable Torque, Low Noise Applications
460 Vac, 3 Phase, 60 Hz	0.5 to 500 hp (up to 590 A)	0.5 to 400 hp (up to 115 A)	0.5 to 75 hp (up to 96 A)
230 Vac, 3 Phase, 60 Hz	1 to 50 hp (up to 143 A)	1 to 40 hp (up to 116 A)	1 to 40 hp (up to 116 A)
200 Vac, 3 Phase, 60 Hz	1 to 50 hp (up to 143 A)	1 to 40 hp (up to 116 A)	1 to 40 hp (up to 116 A)

MCC PACKAGE FEATURES

As standard, basic MCC Altivar 58 TRX AC Drive units include:

- Altivar 58 TRX AC drive.
- Operator keypad display mounted on the front of the unit.
- Disconnect (circuit breaker or fused switch).
- Class J power fuses (for drives less than 125 hp).
- Cooling fans.
- UL 845 Listed for 100,000 amperes short circuit current rating at 480 Vac.
- Control station plate with space for five 22 mm operators.
- Three-phase line reactor for drives above 25 hp variable torque (VT) @ 480 V, or above 20 hp constant torque (CT) or variable torque low noise (VTLN) @ 480 V, or above 10 hp @ 208/240 V.

Most MCC Altivar 58 TRX AC Drive units are plug-on style saddles which can be factory/field-installed in Model 6 MCCs or field-installed in Model 5 MCCs. **There are no placement limitations for mounting any Altivar 58 TRX AC Drive in Square D MCC sections.** Drive units are designed with standard features of Model 6 MCC units, such as:

- White interiors for greater visibility in maintenance.
- Cast metal disconnect handle for ruggedness.
- Twin-handle cam racking mechanism in plug-on units for easy installation/removal.
- Vertical and horizontal wireways are left undisturbed by the drive unit.

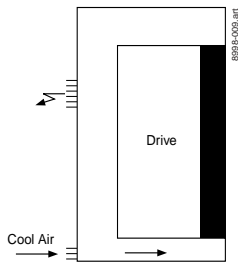
Integral to each MCC AC Drive unit is a thermal management system designed to maintain the drive and other electrical devices at recommended temperatures. The thermal management system included in NEMA/EEMAC Type 1 or 1A (Gasketed) MCC Altivar 58 TRX AC Drive units consists of fans and louvered doors which force outside air across the Altivar 58 TRX AC Drive component for cooling purposes (see the figure on the next page).

The thermal management system included in NEMA/EEMAC Type 12 MCC Altivar 58 TRX AC Drive units consists of a closed duct system to separate outside air from electrical components. Inlet and outlet ducts allow airflow across the metal heatsink fins of the Altivar 58 TRX AC Drive component as shown in the figure on the next page.

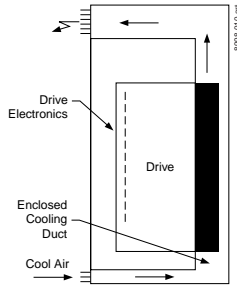
This totally enclosed duct cooled (TEDC) concept achieves the oiltight/dusttight rating required for NEMA/EEMAC Type 12 and removes heat without contaminating the drive electronics or other MCC units with outside air. The thermal management systems are self-powered and include protection to shutdown the drive in case of fan or duct blockage.



Class 8998 Motor Control Centers Factory Options, Monitoring and Indication



**Airflow of
NEMA/EEMAC
Type 1/1A MCC
Altivar 58 TRX
AC Drive Unit**



**Airflow of
NEMA/EEMAC
Type 12 MCC
Altivar 58 TRX
AC Drive Unit**

All MCC Altivar 58 TRX AC Drive units include a digital operator keypad display mounted on the front of the unit. Operator adjustments can be made and diagnostics can be viewed without opening the energized enclosure. The control station plate has pre-punched spaces for five 22-mm Telemecanique pilot devices (factory or field installed). Several factory installed pilot devices are listed on page 218.

Circuit breakers used on the MCC Altivar 58 TRX AC Drive basic units are Square D Mag-Gard® (magnetic only) type. Fusible switches used on the MCC Altivar 58 TRX AC Drive units are bladed switches (molded case switches above 100 A) with Class J fuse clips installed between the drive and the switch. Units below 125 hp include the Class J fuses factory installed.

FACTORY OPTIONS

- Bypass contactors are available as either integrated in the drive or barriered from the drive unit.
- Input contactor.
- Output contactor.
- Extra capacity 120 Vac control power supply for customer use.
- Line reactors.
- Pilot devices.
- Unit extensions to provide additional panel space.
- Wired and unwired control relays.
- Multi-drive cabinets.

MONITORING AND INDICATION

- The front-mounted operator keypad displays setup parameters and the last fault occurrence with four-digit display and plain, multi-language dialog on one line of 16 characters.
- Drive parameters are factory preset for the most common adjustments and the control schemes ordered with the unit.
- Security to prevent accidental adjustments is provided by an access-locking switch on the back of the keypad display. Up to four different programs can be saved in the keypad and retrieved for sharing between multiple drive units.

Real time display of:

- Drive state (running, ready, accelerating, decelerating, etc.).
- Reference frequency (in Hertz).
- Output frequency (in Hertz).
- Motor speed (in revolutions/minute).
- Motor current (in amperes).
- Mains voltage (in volts).
- Motor thermal state (as a percentage).
- Drive thermal state (as a percentage).
- Last fault.

Class 8998 Motor Control Centers AC Drive Options and Basic Drive Power Circuit

- Keypad frequency reference (in Hz).
- Output power (as a percentage of drive rated power).
- Energy consumed (in kilowatts).
- Run time (in hours).

One normally-open contact indication of drive running (closes on run).

One normally-closed contact indication of drive fault (opens on fault).

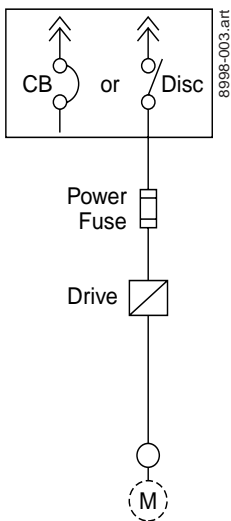
Optional analog output for motor current, motor frequency, ramp output, motor power, and motor torque.

AC DRIVE OPTIONS

- Commissioning software for personal computers.
- 24 Vdc analog I/O extension card (tachometer feedback).
- 24 Vdc digital I/O extension card (encoder feedback).
- Modbus® plus communication card.
- Unitelway/Modbus communication card.
- Profibus DP communication card.
- Ethernet communication card for Transparent Ready™ integration.
- DeviceNet communication card.

BASIC “DRIVE” POWER CIRCUIT

- Consists of disconnect switch and drive pre-programmed for selected options if applicable.
- Includes current-limiting power fuses, if necessary. Power fuses are UL Class J.
- Unit is UL 845 Listed for 100,000 amperes Short Circuit Current.
- Includes operation keypad/display mounted on front of the unit.
- Pilot devices are optional and are only available as 22 mm Telemecanique type pilot devices (five devices maximum).
- Control power transformer (480 V/120 V), if necessary, for enclosure ventilation fans is included.



**Basic “Drive”
Power Circuit**

Class 8998 Motor Control Centers Space Requirements

SPACE REQUIREMENTS

NOTE: In the following tables the horsepower shown is nominal and only for convenience; you should size the controller by the actual motor full-load amperage.

Variable Torque 480 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower at 460 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
0.5 to 3 hp	5.8	12"	24"
5 to 7.5 hp	13	15"	24"
10 to 15 hp	24	24"	36"
20 to 25 hp	34	27"	36"
30 to 50 hp	65	45"	45"
60 to 100 hp	124	72" (20" wide)	72" (20" wide)
125 hp	156	72" (25" wide)	Not available
150 to 250 hp	302	72" (30" wide)	Not available
300 to 500 hp	590	72" (35" wide)	Not available

Variable Torque 208/240 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower 200 / 230 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
1 to 3 hp	11	12"	24"
5 hp	18	15"	24"
7.5 to 10 hp	31	24"	36"
15 to 25 hp	75	45"	45"
30 to 50 hp	143	72" (20" wide)	72" (20" wide)

Constant Torque 480 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower at 460 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
0.5 to 3 hp	5.8	12"	24"
5 to 7.5 hp	13	15"	24"
10 to 15 hp	24	24"	36"
20 hp	33	27"	36"
25 to 50 hp	66	45"	45"
50 to 75 hp	115	72" (20" wide)	72" (20" wide)
100 hp	124	72" (25" wide)	Not available
125 to 200 hp	240	72" (30" wide)	Not available
300 to 400	477	72" (35" wide)	Not available

Class 8998 Motor Control Centers Space Requirements

Constant Torque 208/240 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower 200 / 230 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
1 to 3 hp	11	12"	24"
5 hp	18	15"	24"
7.5 to 10 hp	31	24"	36"
15 to 20 hp	60	45"	45"
25 to 40 hp	116	72" (20" wide)	72" (20" wide)

Variable Torque, Low Noise 480 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower 460 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
0.5 to 3 hp	5.8	12"	24"
5 to 7.5 hp	13	15"	24"
10 to 15 hp	24	24"	36"
20 hp	33	27"	36"
25 to 40 hp	52	45"	45"
50 to 75 hp	96	72" (20" wide)	72" (20" wide)

Variable Torque, Low Noise 208/240 Vac Altivar 58 TRX AC Drives

Motor Rated Horsepower 200 / 230 Vac	Maximum Continuous Output Current (A)	NEMA Type 1 and 1A (Gasketed)	NEMA Type 12
		Space (Height)	Space (Height)
1 to 3 hp	11	12"	24"
5 hp	18	15"	24"
7.5 to 10 hp	31	24"	36"
15 to 20 hp	60	45"	45"
25 to 40 hp	116	72" (20" wide)	72" (20" wide)

POWER CONTACTOR OPTIONS

Only one option is allowed.

Power Circuit Diagram														
Nominal Motor Horsepower (hp) and Type of Torque [▲]			Integrated Bypass Only Available with Circuit Breaker Disconnect; Uses Telemecanique Contactors.	Barriercd Bypass Uses NEMA Contactors	Barriercd Application Rated COMPAC™ 6 Bypass (14 A max.)	Load Contactor	Line Contactor							
208 Vac	240 Vac	480 Vac	Additional Space	Additional Space	Additional Space	Additional Space	Additional Space							
1-5 All	240 Vac	0.5-10 All	12"	18"	6"	12"	12"							
5-10 All	240 Vac	15-20 All and 25 hp VT	12"	18"	Not available	12"	12"							
15-25 VT 15-20 CT 15-20 VTLN	240 Vac	30-50 VT 25-40 CT 25-40 VTLN	9"	27"	Not available	9"	9"							
30-50 VT 25-40 CT 25-40 VTLN	240 Vac	60-100 VT 50-75 CT 50-75 VTLN	5" added to width	33" in adjacent section for circuit breaker; 39" in adjacent section for FS	Not available	5" added to width	5" added to width							
50 VT	240 Vac		5" added to width	25" added to width	Not available	5" added to width	5" added to width							
	480 Vac	125-200 VT 100-200 CT	20" added to width	25" added to width	Not available	Consult factory.	Consult factory.							
			<ul style="list-style-type: none"> Basic Drive features with isolation and bypass contactors for emergency full speed operation in same compartment. Telemecanique D or F line contactors are used. Only available as Circuit Breaker disconnect common to drive and bypass. Drive and bypass are UL 845 Listed for 100,000 A Short Circuit Current and coordinated for Type 1 protection. Includes AFC-Off-Bypass selector switch, Red Push-To-Test "AFC" Pilot Light and Yellow Push-To-Test "Bypass" Pilot Light on bypass control island. <p>NOTE: Bypass is not isolated from the drive compartment. Both drive and bypass must be removed at the same time.</p>	<ul style="list-style-type: none"> Basic Drive features with isolation and bypass contactors for emergency full speed operation. Barriercd Application Rated COMPAC 6 Bypass uses Telemecanique contactors. NEMA contactors are used on barriercd NEMA bypass. Separate disconnect for drive and bypass can be operated independently. Drive and bypass starter are enclosed in separate barriercd compartments. Drive and bypass are UL 845 Listed for 100,000 A Short Circuit Current and coordinated for Type 1 protection. Includes AFC-Off-Bypass selector switch, Red Push-To-Test "AFC" Pilot Light and Yellow Push-To-Test "Bypass" Pilot Light on bypass control island. (Non-Push-To-Test used on COMPAC 6) 	<ul style="list-style-type: none"> Basic Drive features with load contactor for motor isolation. Contactor is open when drive is not running. Telemecanique D or F line contactors are used. Drive and load contactor are UL 845 Listed for 100,000 A Short Circuit Current. 	<ul style="list-style-type: none"> Basic Drive features with line contactor for isolating drive from input line. Telemecanique D or F line contactors are used. Drive and line contactor are UL 845 Listed for 100,000 A Short Circuit Current. 								

▲ Abbreviations for type of torque are as follows: VT = Variable Torque; CT = Constant Torque; VTLN = Variable Torque, Low Noise.

Class 8998 Motor Control Centers

Pilot Devices and Misc. Options

PILOT DEVICES

Pilot Devices (Available as 22 mm only. Choose only one pilot device form number below for each drive.)	Number of Spaces Used (5 maximum available)
Hand-Off-Auto Selector with Manual Speed Potentiometer	2
Start & Stop Pushbuttons with Manual Speed Potentiometer	3
Forward-Off-Reverse Selector with Manual Speed Potentiometer	2
Pilot Lights (Available as LED type, direct supply only.)	
Red "Power On" Light	1
Yellow Push-To-Test "Fault" Light	1
Red Push-To-Test "Run" Light	1
Green Push-To-Test "Run" Light	1
Red Push-To-Test "Stopped" Light	1
Green Push-To-Test "Stopped" Light	1
Yellow Push-To-Test "Hand" and "Auto" Lights	1

MISCELLANEOUS OPTIONS

Option	Space Adder	
Line Reactors Each line reactor is mounted in the MCC cabinet as a separate unit above the drive unit and is factory wired to the line side of the drive. Not available on NEMA Type 12 MCCs.	3% Impedance: 1 to 3 hp, 208/240 Vac 1 to 5 hp, 480 Vac	9"
	3% Impedance: 5 to 10 hp, 208/240 Vac 7.5 to 20 hp, 480 Vac 25 hp VT, 480 Vac	12"
	1% Impedance: 15 to 50 hp, 208/240 Vac 25 CT/VTLN to 500 hp, 480 Vac	Included in drive as standard; no space adder
100 VA Customer Capacity on Drive's 120 V Control Transformer	1 to 3 hp, 208/240 Vac 1 to 3 hp, 480 Vac with Basic Power Option	12"
	All others	0"
Option Cards Choose only one. Each option board is pre-installed onto drive inside unit with all customer terminations left unwired (Type 1A wiring).	Analog I/O Extension Card (VW3A58201U) Note: The bypass and output contactor power options require factory use of 1 logic output on the Analog I/O Extension Card.	0"
	Digital I/O Extension Card (VW3A58202U)	0"
	Modbus Plus Communication Card (VW3A58302U)	0"
	Modbus/Unitelway Communication Card (VW3A58303U)	0"
	Profibus DP Communication Card (VW3A58307U)	0"
	Johnson Controls N2 Communication Card (VW3A58354U)	0"
	Landis & Staefa P1 Communication Module (1000-6A58-KP1)	0"
	Ethernet Communication Card (VW3A58310U)	0"
DeviceNet Communication Card (VW3A58309U)	0"	
Dynamic Braking Resistors The use of braking resistors dissipates excess energy generated by the motor whenever the motor functions in the generator mode as on high-inertia loads or machines driving a load. Resistors are mounted in the MCC cabinet as a separate unit above the drive unit and are factory wired to the DC bus of the drive. Not available in NEMA Type 12 MCCs.	1 to 2 hp, 208/240 Vac 1 to 10 hp, 480 Vac	6"
	3 to 10 hp, 208/240 Vac 15 to 20 hp, 480 Vac	9"
	15 to 20 hp, 208/240 Vac 25 to 40 hp, 480 Vac	9"
Basic Unit Extenders Provides the amount of additional space shown in the Space Adder column below the drive unit for customer-added devices with a single door to cover the drive and added space. Only available for Basic Power Option.	1 to 10 hp, 208/240 Vac 1 to 20 hp, 480 Vac	3", 6", 12"
	15 to 50 hp Variable Torque, 208/240 Vac 15 to 40 hp Constant Torque, 208/240 Vac 15 to 40 hp Variable Torque, Low Noise, 208/240 Vac 25 to 50 hp Variable Torque, 480 Vac 25 to 40 hp Constant Torque, 208/240 Vac 25 to 40 hp Variable Torque, Low Noise, 208/240 Vac	3", 6", 9"

Class 8998 Motor Control Centers Pilot Devices and Misc. Options

Option	Space Adder	
Control and Timing Relays	<p>Auto Start Relay without Delay Provides interposing relay for starting the drive in auto mode via customer-supplied 120 Vac. Requires Hand-Off-Auto selector switch.</p>	<p>3" for 1 to 20 hp, 480 Vac and 1 to 10 hp, 208/240 Vac models.</p> <p>0" for all other models.</p>
	<p>Auto Start Relay with Delay Provides interposing relay for starting the drive in auto mode after a delay (adjustable from 1.5 to 30 seconds) via customer-supplied 120 Vac. Requires Hand-Off-Auto selector switch.</p>	
	<p>Unwired Relay Provides unwired D-line relay with 2 N.O./2 N.C. contacts, 120 Vac coil, Type 1A wiring.</p>	
	<p>Unwired On Delay Timer Provides unwired D-line relay with 2 N.O./2 N.C. untimed contacts and 1 N.O./1 N.C. 10 to 180 second on-delay contacts, 120 Vac coil, Type 1A wiring.</p>	
	<p>Unwired Off Delay Timer Provides unwired D-line relay with 2 N.O./2 N.C. untimed contacts and 1 N.O./1 N.C. 10 to 180 second off-delay contacts, 120 Vac coil, Type 1A wiring.</p>	
	<p>Wired Relay Provides D-line relay with 2 N.O./2 N.C. contacts wired per customer provided diagrams.</p>	
	<p>Wired On Delay Timer Provides D-line relay with 2 N.O./2 N.C. untimed contacts and 1 N.O./1 N.C. 10 to 180 second on-delay contacts wired per customer provided diagrams.</p>	
	<p>Wired Off Delay Timer Provides D-line relay with 2 N.O./2 N.C. untimed contacts and 1 N.O./1 N.C. 10 to 180 second off-delay contacts wired per customer provided diagrams.</p>	

Class 8998 Motor Control Centers Multi-Drive Process Line Cabinets

MULTI-DRIVE PROCESS LINE CABINETS

MCC-style 90" high relay sections are available with group-mounted Altivar 58 TRX AC drives. All drives are installed together in one cabinet instead of individual plug-on MCC units. This allows greater density and reduces floor space over traditional MCC unit construction. Drives are not isolated from each other, and are fed from one circuit breaker disconnect.

Multi-drive process line cabinets are suited for process line applications where a fault or maintenance of one drive on the process requires the entire process to shut down. Applications in automotive, food and beverage, pharmaceutical, and other process industries using multiple drives for a single process machine are candidates for this product. Pre-engineered, pre-assembled packaging saves third-party assembly labor and commission time on simple installations.

An efficient cooling system and current-limiting fuses provide factory-assured, UL-certified performance to UL 845 MCC standards. Each drive has a uniquely numbered door-mounted keypad for easy monitoring and setup. Drives can be set up with a program from a single keypad if preferred.

Only drives rated 480 Vac are available and are pre-programmed for constant torque applications. No control pilot devices or 120 Vac control power is available, making this package more suited for simple remote control schemes or for further integration in the field. Packages are designed for NEMA Type 1 environments. Horizontal bus is provided for splicing to existing Model 5 or 6 MCC sections or an additional MCC incoming line section.

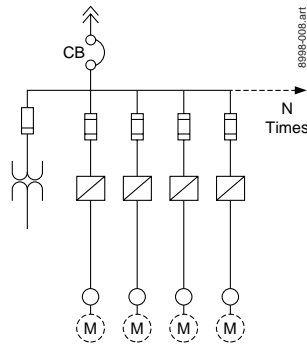
Any number of drives up to the maximum indicated in the table below may be installed in the multi-drive process line cabinet. However, all drives in the same cabinet must be of the same rating. Panels for adding the maximum number of drives will be installed.



multi10d_489%



multi10_346%



- Consists of MCC relay section with multiple drives of the same rating fed from a single circuit breaker disconnect.
- Current-limiting power fuses are included for each drive. Power fuses are UL Class CC or T.
- Package is UL 845 Listed for 65,000 A short circuit current.
- Keypad displays for each drive are mounted on the door of the cabinet.
- No pilot devices are available as standard.
- Control power transformer (480 /240 Vac) for cabinet ventilation fans is included.
- Any number of drives from one to the maximum indicated can be factory installed.
- Drives must be of the same rating in a single cabinet.

Motor-Rated Horsepower at 460 Vac	Type of Torque	Maximum Continuous Output Current (A)	Maximum Number of Drives per Section	Space Adder
1	All types	2.3	10	72" (25" wide x 20" deep)
2	All types	4.1		
3	All types	5.8		
5	All types	10	8	72" (25" wide x 20" deep)
7.5	All types	13	6	
10	All types	17	4	
20	All types	33	2	72" (30" wide x 20" deep)
	25	Variable Torque			34
	Constant Torque	40		
30	Variable Torque	40		
	Constant Torque	48		
40	Variable Torque	52		
	Constant Torque	66		
50	Variable Torque	65		

Class 8998 Motor Control Centers Sample Specifications

Section 16483-1 Motor Control Center Adjustable Frequency Drive Controller

NOTE: These specifications are for Altivar 58 TRX adjustable frequency drive controllers, herein referred to as AC inverters, to be mounted in Square D Motor Control Centers. The Motor Control Center specification Section 16443 must be used in conjunction with these specifications in order to specify a complete Motor Control Center.

Application information directly affects the type and size of AC drive controller unit that will be quoted. Brackets [] are provided where such data should be included.

Please call your local Square D distributor or sales engineer for specification assistance regarding a particular application.

The Adjustable Frequency Drive Controller specification should be included in Division 16, Electrical with the electrical distribution system.

PART 1: GENERAL

1.01 Scope of Work

- a. This section provides specification requirements for AC inverter type adjustable frequency, variable speed drives packaged as a complete motor control center unit or herein identified as AC drive controller units for use with [NEMA A] [NEMA B] [NEMA C] [NEMA E] [Wound Rotor] [Synchronous] design AC motors.
- b. The AC drive controller unit manufacturer shall furnish, field test, adjust, and certify all installed AC drive controller units for satisfactory operation.
- c. Any exceptions/deviations to this specification shall be indicated in writing and submitted with the quotation.

1.02 Submittals

- a. Submit with the delivery of the MCC an Installation and Maintenance Manual and one (1) copy if the manufacturer's drawings per shipping block.

1.03 Regulatory Requirements

- a. ANSI/NFPA 70 — National Electric Code.
- b. ANSI C84.1 — Voltages Tolerances for North America.
- c. CSA C22.2 No. 14-M91 — Industrial Control Equipment.
- d. IEC 60146.1 — Semiconductor Converters — General Requirements and Line Commutated Converters Part 1-1: Specifications of Basic Requirements.
- e. IEC 60721 — Classification of Environmental Conditions.
- f. NEMA ICS 3, Part 1 — Motor Control Centers Not Rated More Than 600 Volts AC.
- g. NEMA Publication 250 — Enclosures for Electrical Equipment.
- h. UL 508 — UL Standard for Safety for Industrial Control Equipment.
- i. UL 508C — UL Standard for Safety for Power Conversion Equipment.
- j. UL 845 — UL Standard for Safety for Motor Control Centers.
- k. UL 50 — UL Standard for Safety for Enclosures for Electrical Equipment.

1.04 Warranty

- a. The AC drive controller unit shall be warranted to be free from defects in materials and workmanship for a period of eighteen (18) months from date of shipment.

Class 8998 Motor Control Centers

Sample Specifications

1.05 Quality Assurance

- a. The AC drive controller unit and all selected catalog options shall be UL Listed according to Motor Control Center Equipment Specification UL 845. A UL label shall be attached inside each AC drive controller unit as verification.
- b. The AC drive controller unit shall be designed, constructed, and tested in accordance with NEMA and NEC standards, and shall be NOM and CSA certified.
- c. The AC inverter and motor control center shall be manufactured by one supplier in an ISO 9001 certified facility.
- d. Every AC inverter shall be tested with an actual AC induction motor, 100% loaded and temperature cycled within an environment chamber at 40 °C (104 °F). Documentation shall be furnished to verify successful completion at the request of the engineer.
- e. The manufacturer of the AC drive controller unit shall have been specialized in the design and production of motor control center drive units for a period of at least 10 years.
- f. All factory supplied options shall be completely tested for successful operation before shipment. Documentation shall be furnished upon the request of the engineer.
- g. Units shall be manufacturer's standard factory construction. Manufacturer's catalog pages documenting MCC units to be supplied shall be submitted for approval.

PART 2: PRODUCTS

2.01 Acceptable Manufacturers

- a. The AC drive controller unit shall be Square D Company Class 8998 Altivar 58 *TRX* or prior approved equal. Substitutions must be submitted in writing three (3) weeks prior to the original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.
- b. Additions to existing MCCs shall be the same as the original manufacturer.
- c. Alternate control techniques other than pulse-width modulation technology (PWM) are not acceptable.

2.02 General Description

- a. The AC inverter shall convert the input AC mains power to an adjustable frequency and voltage as defined in the following sections.
- b. The input power section shall utilize a 6-pulse bridge rectifier design [with line reactors for effective harmonic mitigation]. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. This power section shall be insensitive to phase rotation of the AC line.
- c. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize intelligent power modules (IPMs) as required by the current rating of the motor.

2.03 Construction

- a. The AC drive controller unit shall be a combination disconnect-drive motor control center style unit. The input [circuit breaker] [fusible switch] shall provide NEC required branch circuit protection. The [circuit breaker] [fusible switch] shall have an external operator. Wiring between the AC inverter and the disconnect shall not be disturbed when removing or installing the AC drive controller unit from the motor control center.
- b. Units should be of modular construction so that it is possible to readily interchange units of the same size without modifications to the MCC structure.
- c. Current-limiting power fuses or reactors shall be factory installed and wired ahead of the AC inverter input.
- d. All conducting parts on the line side of the unit disconnect shall be isolated to prevent accidental contact with those parts.
- e. AC drive controller units up to 50 hp variable torque shall be plug-on units which connect to the vertical bus through a spring-reinforced stab-on conductor. Units larger than 50 hp variable torque

Class 8998 Motor Control Centers Sample Specifications

- shall be connected directly to the main horizontal bus with appropriately size cable or riser bus.
- f. All AC drive controller units shall be enclosed in a structure which contains a 12" (305 mm) high horizontal wireway at the top of each section, and a 6" (152 mm) high horizontal wireway at the bottom of each section. These wireways should be unobstructed the full length of the motor control center to allow room for power and control cable to connect between units in different sections.
 - g. A full-depth vertical wireway shall be provided within motor control center sections containing AC drive controller units up to 50 hp variable torque. The vertical wireway shall connect both the top and bottom horizontal wireways, and shall be isolated from the AC drive controller unit interiors by a full height barrier. The vertical wireway shall be at least 4" (102 mm) wide with a separate hinged door. There should be a minimum of 4,000 cubic inches (65,548 cubic millimeters) of cabling space available. Access to the wireways shall not require opening control unit doors. AC drive controller units that require a full section are not required to have vertical wireways.
 - h. All AC drive controller unit interior mounting panels shall be white for better visibility inside.
 - i. The motor control center structure shall include unit mounting shelves with hanger brackets to support AC drive controller units up to 50 hp variable torque during installation and removal. A twin handle camming lever shall be located at the top of AC drive controller units up to 50 hp variable torque to rack the unit in and out.
 - j. A cast metal handle operator shall be provided on each AC drive controller unit disconnect. With the AC drive controller unit connected to the motor control center bus and the AC drive controller unit door closed, the handle mechanism shall allow complete *on/off* control of the unit disconnect, with clear indication of the disconnect's status. All circuit breaker operators shall include a separate *tripped* position to clearly indicate a circuit breaker trip condition. It shall be possible to reset a tripped circuit breaker without opening the control unit door.
 - 1. A mechanical interlock shall prevent an operator from opening the AC drive controller unit door when the disconnect is in the *on* position. Another mechanical interlock shall prevent an operator from placing the disconnect in the *on* position while the AC drive controller unit door is open. It shall be possible for authorized personnel to defeat these interlocks.
 - 2. A non-defeatable interlock shall be provided between the handle operator and the structure to prevent installing or removing a plug-on AC drive controller unit unless the disconnect is in the *off* position.
 - k. Provisions shall be provided for locking all disconnects in the *off* position with up to three padlocks.
 - l. All plug-on AC drive controller units shall have a grounded stab-on connector which engages the vertical ground bus prior to, and releases after, the power bus stab-on connectors.
 - m. Handle mechanisms shall be located on the left side to encourage operators to stand to the left of the unit being switched.
 - n. Unit construction shall combine with the vertical wireway isolation barrier to provide a fully compartmentalized design.
 - o. All AC drive controller units shall be provided with unit control terminal blocks for use in terminating field wiring. Terminal blocks shall be pull-apart type, 250 Vac, and rated for 10 A. All current-carrying parts shall be tin-plated. Terminals shall be accessible from inside the unit when the unit door is opened. The stationary portion of the terminal block shall be used for factory connections and will remain attached to the unit when the portion used for field connection is removed. The terminals used for field connections shall be accessible so they can be wired without removing the unit or any of its components.

2.04 Thermal Management

- a. The AC drive controller unit shall incorporate a self-contained air-based cooling system. Any air exhaust vents shall be louvered to help direct air flow away from personnel operating the AC drive controller unit. Any fans, ductwork, or filters shall be easily accessible for maintenance.
- b. The AC drive controller unit cooling system shall be sized to cool the drive regardless of mounting location within the motor control center. The AC drive controller unit shall not be restricted to a specific location in the motor control center.

Class 8998 Motor Control Centers

Sample Specifications

- c. An internal overtemperature trip shall be provided to detect cooling system failure or blockage. Upon occurrence of an overtemperature trip, the cooling system fans shall continue running to provide a rapid cool down.
- d. Power for the cooling system shall be provided internal to the AC drive controller unit by use of a control power transformer which includes two primary fuses and one secondary fuse (in the non-ground secondary conductor).

2.05 Motor Data

- a. The AC drive controller unit shall be sized to operate the following AC motor:
 - 1. Motor horsepower:
[1, 2, 3, 5, 7.5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 100, 125, 150, 200, 250, 300, 350, 400, 450, 500]
 - 2. Motor full-load amperage: [_____]
 - 3. Motor rpm: [3600/3000] [1800/1500] [1200/1000] [900/750] [720/600] [600/500], 50/60 Hz
 - 4. Motor voltage: [208, 230, 460]
 - 5. Motor service factor: [1.0] [1.15] [1.25]

2.06 Application Data

- a. The AC drive controller unit shall be sized to operate [a Variable Torque] [a Constant Torque] [a Variable Torque, Low Noise] [a Constant Horsepower] [an Impact] load.
- b. The speed range shall be from a minimum speed of 0.1 Hz to a maximum speed of 500 Hz.

2.07 Environmental Ratings

- a. The AC drive controller unit shall be designed for operation in a [NEMA Type 12] [NEMA Type 1] [NEMA Type 1 Gasketed] Motor Control Center enclosure specified elsewhere. The AC drive controller unit shall meet IEC 60664-1 and NEMA ICS 1 Annex A.
- b. The AC drive controller unit shall be designed to operate while mounted in a motor control center structure with an ambient temperature from 0 to +40 °C (+32 to +104 °F).
- c. The storage temperature range shall be -25 to +65 °C (-13 to +149 °F).
- d. The maximum relative humidity shall be 93% at 40 °C (104 °F), non-condensing.
- e. The AC drive controller unit shall be rated to operate at altitudes less than or equal to 1000 m (3300 ft). Derating factors shall be applied above 1000 m (3300 ft) for the drive unit and MCC.

2.08 Electrical Ratings

- a. The AC drive controller unit shall be designed to operate from an input voltage of [480] [240] [208] Vac +/-10%.
- b. The AC drive controller unit shall operate from an input voltage frequency range from 57 to 63 Hz.
- c. The displacement power factor shall not be less than 0.98 lagging under any speed or load condition.
- d. The efficiency of the AC inverter at 100% speed and load shall not be less than 97%.
- e. [The variable torque overtorque capacity shall be 110% for one minute.] [The constant torque overtorque capacity shall be 160% for one minute.]
- f. The output carrier frequency of the AC inverter shall be selectable between 0.5 and 16 kHz depending on inverter rating for low noise operation.
- g. The AC inverter will be able to develop rated motor torque at 0.5 Hz (60 Hz base) in a Sensorless Flux Vector mode using a standard induction motor without an encoder feedback signal.
- h. All AC drive controller unit feeder equipment including conductors, lugs, disconnects, contactors, and so forth shall be sized per NEC 430-2 for the AC drive input current rating. An impedance range corresponding to a 22,000 to 100,000 A fault availability level shall be assumed. An AC drive input current rating label shall be attached inside each enclosure to enable feeder sizing.

2.09 Protection

- a. The AC drive controller unit shall be protected against fault currents up to and including 100,000 A rms symmetrical at 480 Vac and shall be UL 845 listed as verification.
- b. Upon power-on, the AC inverter shall automatically test for a valid operation of memory, option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power, and the pre-charge circuit.
- c. The AC drive controller unit shall be protected against short circuits between output phases, between output phases and ground, on the internal power supplies, and on the logic and analog outputs.
- d. The AC drive controller unit shall have a minimum AC undervoltage power loss ride-through of 200 milliseconds (12 cycles). The AC inverter shall have the user-defined option of frequency fold-back to increase the duration of the power-loss ride-through.
- e. The AC inverter will have a selectable ride through function which will allow the logic to maintain control for a minimum of one second (60 cycles) without faulting.
- f. For a fault condition (other than ground fault, short circuit, or internal fault), an auto restart function shall provide up to six restart attempts. The time delay before restart attempts shall be 30 seconds.
- g. The deceleration mode of the AC inverter shall be programmable. The stop modes shall include freewheel stop, fast stop, and DC injection braking.
- h. Upon loss of the analog process follower reference signal, the AC inverter shall be programmable to fault or operate at the user-defined low speed setting.
- i. The AC inverter shall have solid-state I²t protection that is UL Listed, meets UL 508C as a Class 10 overload protection, and meets IEC 60947. The minimum adjustment range shall be from 0.45% to 1.05% of the nominal current rating of the AC drive controller unit.
- j. The AC inverter shall have a programmable skip frequency with a bandwidth of 2.5 Hz.
- k. The AC inverter shall have a programmable fold-back function that will anticipate drive overload condition and fold back the frequency to avoid a fault condition.
- l. The output frequency shall be software enabled to foldback when the motor is overloaded.

2.10 Adjustments and Configurations

- a. The AC inverter motor and control parameters will be factory preset to operate most common applications. Necessary adjustments for factory-supplied unit operator controls and sequencing shall be pre-programmed and tested by the manufacturer.
- b. A choice of two types of acceleration and deceleration ramps will be available in the AC inverter software, linear or S-curve.
- c. The acceleration and deceleration ramp times shall be adjustable from 0.05 to 999.9 seconds.
- d. The volts/frequency ratios shall be user selectable to meet variable torque loads for normal and high-torque machine applications.
- e. The memory shall retain and record the last fault for operator review.
- f. The software shall have an Energy Economy (no load) function that will reduce the voltage to the motor when selected for variable torque loads. A constant volts/hertz ratio will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirement of the load.
- g. The AC inverter shall have an output signal with a user-selectable threshold that can be used to signal motor overtemperature before a motor overload fault.
- h. The AC inverter shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator.

Class 8998 Motor Control Centers

Sample Specifications

2.11 Operator Interface

- a. The operator interface terminal will offer the modification of AC inverter adjustments via a touch keypad. All electrical values, configuration parameters, I/O assignments, application and activity function access, faults, local control, and adjustment storage will be in plain English. There will be a standard selection of four additional languages built-in to the operating software as standard.
- b. As a minimum, the selectable display outputs shall consist of speed reference, output frequency, output current, line voltage, output power, energy consumed, run time, motor thermal state, drive thermal state, and motor speed.
- c. A keypad scrolling function shall allow dynamic switching between display variables.
- d. A programmable access code will limit access to programmable functions. A hardware selector switch shall allow the terminal keypad to be locked out from unauthorized personnel.
- e. The keypad shall store in non-volatile memory up to four user configuration parameters. An operator shall have the ability to download a stored configuration to multiple AC inverters.
- f. There will be arrow keys that will provide the ability to scroll through menus and screens, select or activate functions, or change the value of a selected parameter.
- g. A data entry key will allow the user to confirm a selected menu, numeric value, or allow selection between multiple choices.
- h. A RUN key and a STOP key will command normal starting and stopping as programmed when the AC drive controller unit is in keypad control mode. The STOP key must be active in all control modes.
- i. A user interface shall be available through a Windows-based personal computer, serial communication link, or detachable operator interface.
- j. The operator interface shall be MCC door mounted on the AC drive controller unit for ease of access and increased visibility.
- k. The keypad and all door-mounted controls shall be NEMA Type 12 rated.

2.12 Control

- a. External pilot devices shall be able to be mounted on a door-mounted control station for starting and stopping the AC drive controller unit, speed control, and displaying operating status. All control inputs and outputs shall be software assignable. Software assignments for control inputs and outputs to operate factory-supplied controls shall be pre-configured from the factory.
- b. Strategies for 2-wire or 3-wire control shall be defined within the software.
- c. The control power for the digital inputs and outputs shall be 24 Vdc.
- d. The internal power supply incorporates an automatic current fold-back that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs shall be current-limited and not be damaged if shorted or excess current is pulled.
- e. All logic connections shall be furnished on pull-apart terminal strips.
- f. There shall be two software-assignable, isolated analog inputs. One analog input shall be software-selectable and consist of the following configurations: 0 to 20 mAdc, 4 to 20 mAdc, 20 to 4 mAdc, x to 20 mAdc (where x is user-defined). The other analog input shall be 0 to 10 Vdc.
- g. There shall be four isolated logic inputs, three that shall be selected and assigned in the software.
- h. Two voltage-free Form C relay output contacts shall be provided. One of the contacts shall indicate AC inverter fault status; the other contact shall be user-assignable.
- i. There shall be one software-assignable analog current output configurable between x and y mADC (where x and y are user defined from 0 to 20 mADC). The analog output shall be updated every 2ms maximum.

2.13 Optional General Purpose Input/Output Extension

- j. There shall be a general-purpose hardware extension module incorporated with each AC drive controller. The module shall be fully isolated and have pull-apart terminal strips. The module shall add three analog outputs and one Form C relay output. All of the analog outputs shall be user-assignable. Additional loss of follower functionality shall include the ability to run at the last valid speed reference or a selectable preset speed.

2.14 Optional Isolation/Bypass Contactors

- a. The AC drive controller unit shall include a UL Listed option [NEMA rated isolation and bypass contactors packaged as a separate MCC unit with steel barriers segregating the AC inverter from the bypass starter] [IEC rated isolation and bypass contactors integrated with the AC inverter as one MCC unit to reduce space] complete with thermal overload relay, disconnect interlocked with the door, control circuit transformer, motor flux decay timer, and an AFC/OFF/BYPASS switch. The operator shall have full control of the bypass starter by operation of the door-mounted selector switch.

2.15 Harmonic Analysis

NOTE: The amount of harmonic distortion at the point of common coupling (PCC) is due to the distribution system characteristics (impedance of the source) and the power source size relative to the AC drive load. The harmonic current magnitude and voltage distortion values can be predicted through computer modeling. If the resulting calculations determine that the harmonic distortion will be above the IEEE-519 specification of 5%, a line reactor can be supplied to lower the harmonic levels. The line reactor is mounted at the AC drive input to reduce the current harmonics that are fed back into the supply.

- a. A harmonic analysis shall be performed and priced as a separate line item by the AC drive controller unit manufacturer based upon system documentation consisting of, but not limited to, one-line diagrams and specific distribution transformer information consisting of kVA, %Z, and X/R data. The data shall consist of but not be limited to total harmonic voltage distortion and total rms current.
- b. The line reactor, if required, shall be provided as a separate, ventilated [NEMA Type 1 Gasketed] [NEMA Type 1] MCC unit completely factory wired and tested with the AC drive controller unit.

PART 3: EXECUTION

3.01 Inspection

- a. Verify that the location is ready to receive work and the dimensions are as indicated.
- b. Do not install the AC drive controller unit until the building environment can be maintained within the service conditions required by the manufacturer.

3.02 Protection

- a. Before and during the installation, the AC drive controller unit shall be protected from site contaminants.

3.03 Installation

- a. Installation shall be in compliance with the manufacturer's instructions, drawings, and recommendations.
- b. The AC drive controller unit manufacturer shall provide a factory-certified technical representative to supervise the contractor's installation, testing, and start-up of the AC drive controller unit(s) furnished under this specification for a maximum total of [_____] days.

3.04 Training

- a. An on-site training course of [_____] training days shall be provided by a representative of the AC drive controller unit manufacturer to plant and/or maintenance personnel, and quoted as a separate line item.

**Class 8998 Motor Control Centers
Sample Specifications**

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