

VARIABLE FREQUENCY DRIVE

USER MANUAL



ACH580



innergytech

setting the standard
for **energy recovery**

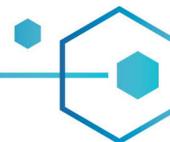
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HEAT PIPES • PLATES
WHEELS • CORES



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ABOUT THIS MANUAL

This manual should be used as your main reference through the Installation, operation and maintenance of your new Variable Frequency Drive (VFD).

By following the instructions listed in this document, years of economical and satisfactory operation will be obtained. Please read this manual thoroughly.

Please take note that this manual uses the following symbols to emphasize particular information:



WARNING: Identifies an instruction which, if not followed, might cause serious personal injuries including possibility of death.



CAUTION: Denotes an instruction which, if not followed, may severely damage the unit and/or its components.



NOTE: Indicates supplementary information needed to fully complete an instruction.

If more information is needed, please contact your local Innery tech Sales Representative or the Innery tech Service Department.

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1. UNIT DESCRIPTION

The Innergy tech ACH 580 VFD controller package is designed to provide complete control support for all i4 wheel products.

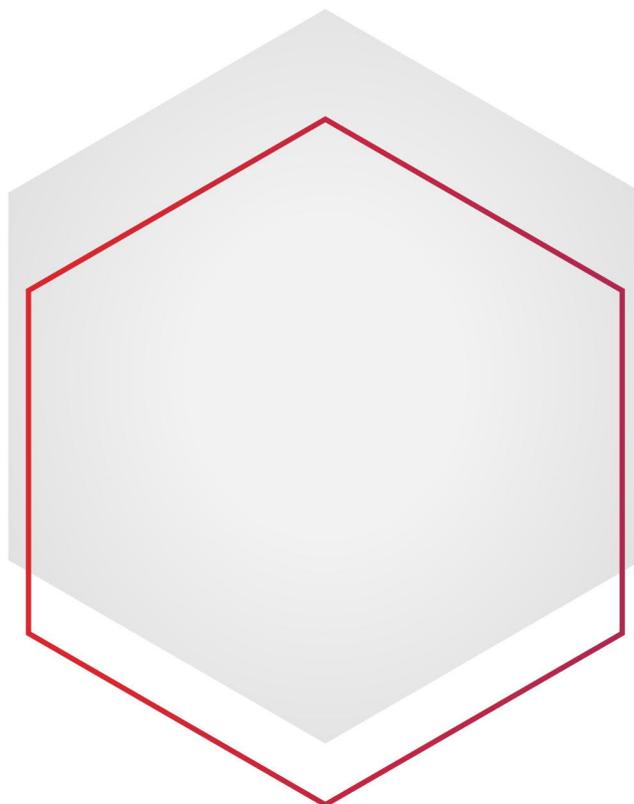
Unlike other controllers which rely on a variable frequency drive as well as a separate controller, the Innergy tech ACH580 VFD controller package benefits from the extensive VFD programming capacity to eliminate the need of a separate controller entirely. The drive and controller are therefore united to form an "intelligent" drive system.

Proprietary Innergy tech programming optimisations result in full implementation of all analog inputs for smooth free-cooling (with summer changeover) and frost control modulations. In addition, VFD mode (heating, cooling, frost control or free-cooling) as well as wheel temperature efficiency status are available in real time through the large VFD LCD screen or remote through your preferred communication protocol (S-422/485 Modbus or BACnet).

The kit comes complete with four (4) 4-20mA IP67 pre-installed temperature sensors located in the outside air (TEMP1), supplied air (TEMP2), return air (TEMP3) and exhaust air (TEMP4) streams. A magnetic rotation sensor also come standard with all VFD kits to monitor wheel rotation speed and warn the BMS in case of rotor failure.

When ordered with an i4 wheel, all sensors will not only be pre-installed on your wheel but will also be fully wired to a sensor terminal box with a quick connector junction. The matching male quick connector with 50ft of wire means the only field connection required is at the VFD main terminal board.

Wheel rotation speed will vary proportionally with the VFD's frequency variation from its maximum speed of 20 RPM (60 Hz input) to its minimum speed of 1/4 RPM (0.75 Hz input). This 80:1 speed ratio results in total capacity control (0 to 100%) of the energy recovery wheel.





2. VFD TERMINOLOGY

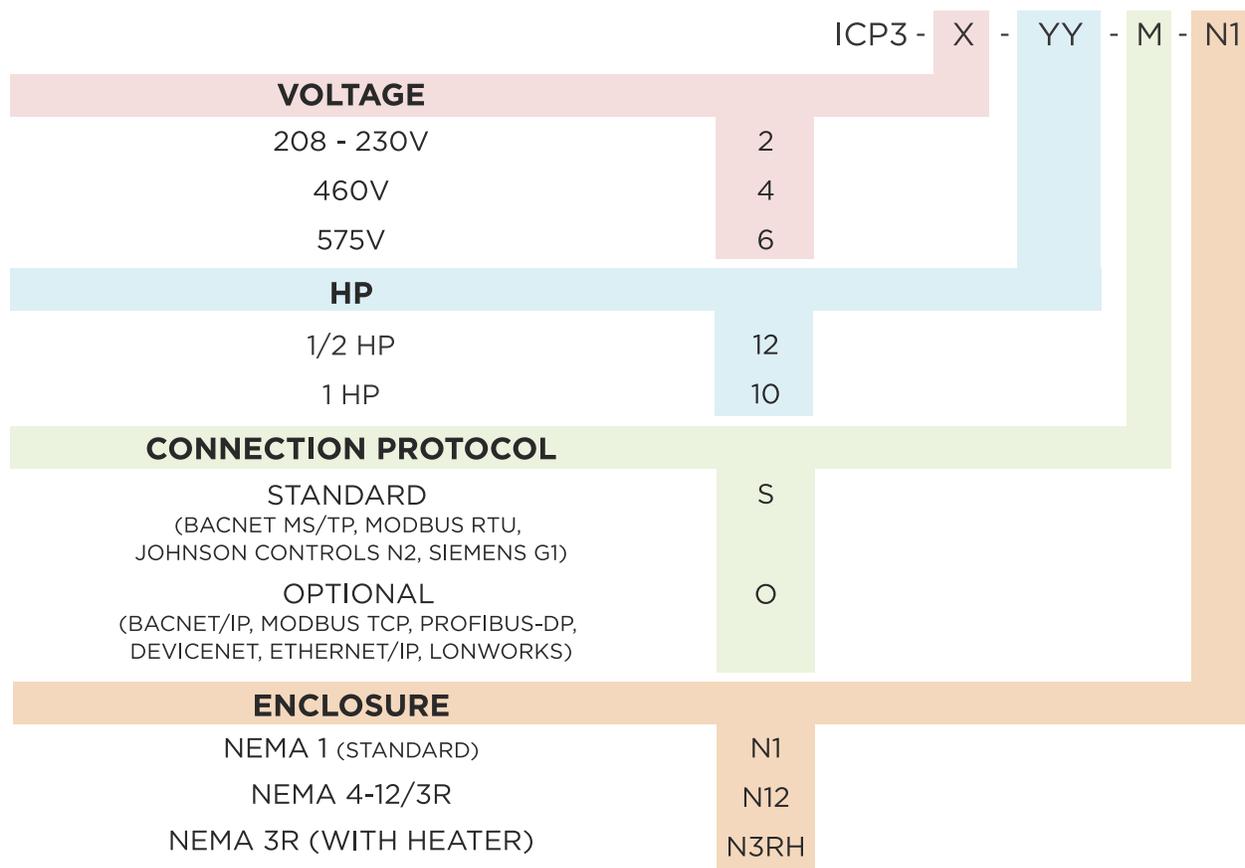
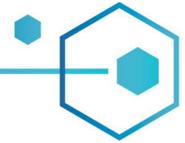


Figure 1



3. SEQUENCE OF OPERATION

COOLING MODE: When outdoor air temperature (TEMP1) is greater than the return air temperature (TEMP3), the wheel operates in cooling mode at its full effectiveness and maximum speed of 20 RPM.

FROST CONTROL MODE: When the exhaust air temperature (TEMP4) reaches the frost control setpoint (default 34°F), the wheel's speed is modulated in order to avoid ice formation within the wheel's media.

FREE COOLING (ECONOMIZER) MODE: When outdoor air temperature (TEMP1) is lower than the return air temperature (TEMP3) but supplied air temperature (TEMP2) reaches the free cooling setpoint (default 60°F), the wheel's speed is modulated in order to prevent the supplied air (TEMP2) from exceeding the free cooling setpoint.

HEATING MODE: When outdoor air temperature (TEMP1) is lower than the return air temperature (TEMP3); when the exhaust air temperature (TEMP4) is above the frost setpoint (default 34°F) and supplied air temperature (TEMP2) is below the free cooling setpoint (default 60°F), the wheel operates in heating mode at its full effectiveness and maximum speed of 20 RPM.



Note: Frost control and free cooling setpoints can be changed to suit specific projects.

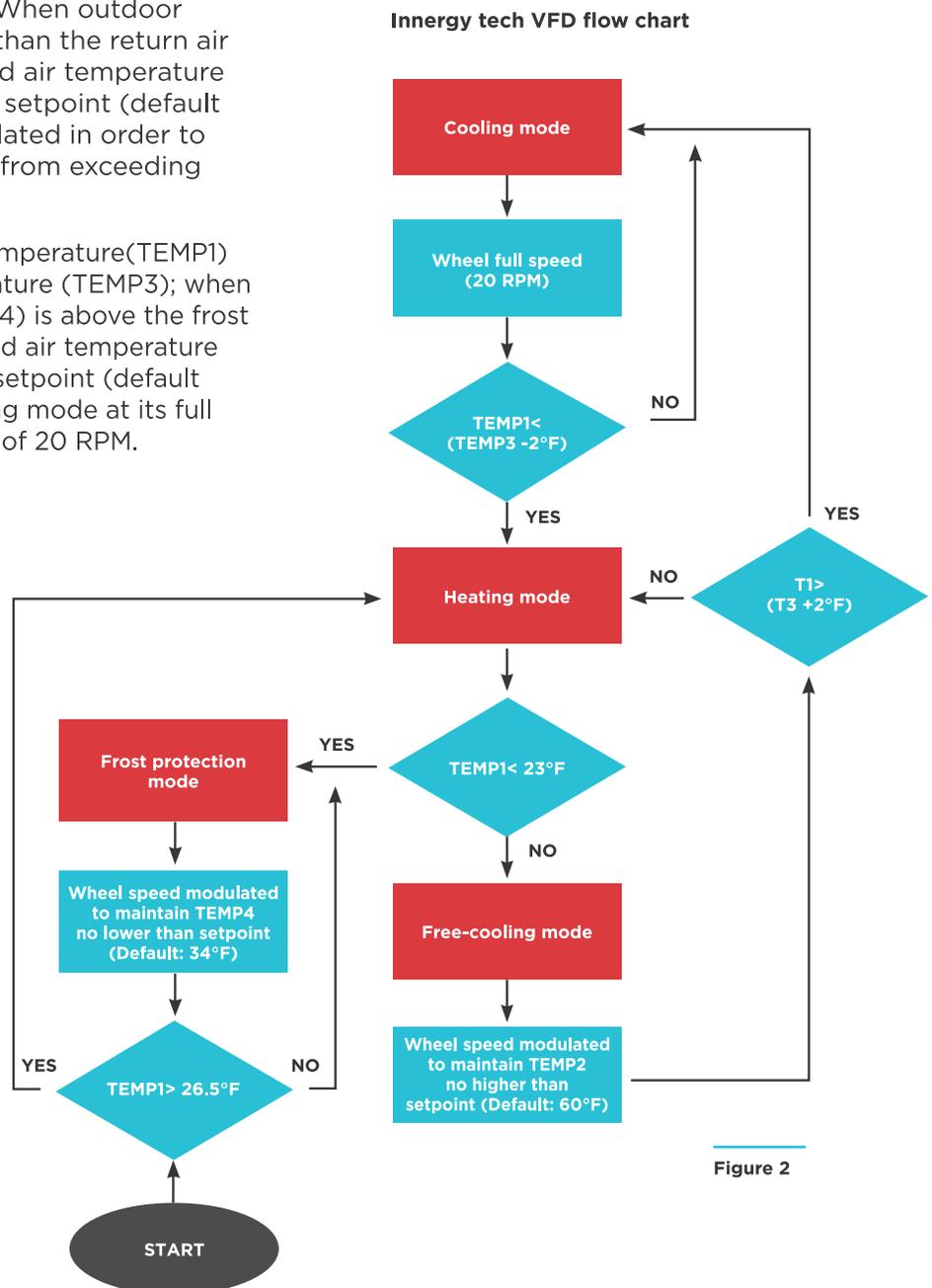


Figure 2



4. ROTATION DETECTION

4.1 Rotation Sensor

Standard with all of our variable frequency drive controller kits is a magnetic rotation sensor. When ordered with our wheels, the sensor will be fully installed (motor side) and wired to our sensor terminal box. For VFD kits ordered separately, sensor installation instructions will be provided.

An alarm signal will be triggered if the rotation sensor does not detect rotation for a period of 5 minutes. See our register guide error codes section for addresses details.

Note that if desired, the rotation detection can be disabled by changing the input in the VFD LCD panel address 47.22 to 0.



Figure 3

Rotation Sensor installation location

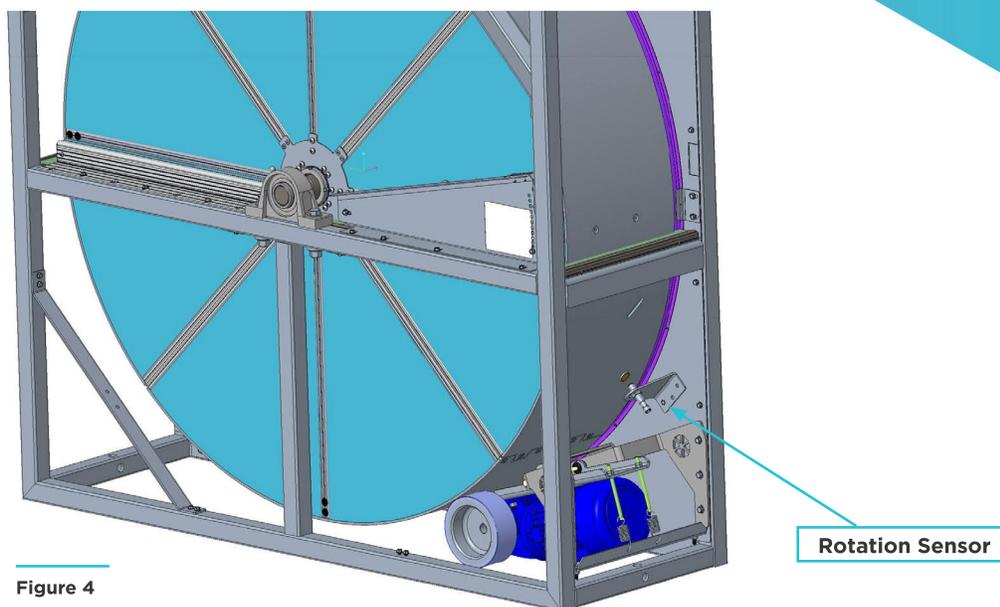


Figure 4



Note: The rotation sensor installation side will follow the motor location so can be installed either to the left or right side depending on your selected wheel configuration.



5. TEMPERATURE SENSORS

5.1 General considerations

The standard temperature sensors provided with the VFD are 1/4" diameter stainless steel probes. They provide an analog output linear proportional to the calibrated temperature range. Signal conditioning is performed by industrial quality factory calibrated integrated circuits to provide a true linear output. For VFD packages ordered separately, the temperature sensors are shipped loose for field installation (please refer to our sensor installation guide document for further details). For VFD packages ordered with our energy recovery wheels, all sensors will be pre-installed on the wheel in their correct locations as shown in figure 6.

5.2 VFD kits ordered with your Innergy tech energy recovery wheel

For all VFD packages ordered with an energy recovery wheel, the four temperature sensors as well as rotation sensor will already be fully installed on the wheel and linked to the sensor junction box (figure 6).

Installation steps:

1. Connect the male Amp connector to the wheel sensors junction box.
2. Run the 50ft of wire to the VFD terminal board (if the provided 50ft of wire is not enough, a junction can be made and the wire lengthen for up to 300ft without affecting the signal. Note that an 8 strands, 18 Gauge wire is required).
3. Final connections at the main terminal board should be made following the wiring diagram of section 11.1.

5.3 VFD kits ordered separately

For VFD kits ordered separately, the VFD package, sensors and all required hardware will be shipped loose for field installation by the customer. Please follow the supplied sensor installation guide carefully to complete the installation. Contact the Innergy tech sales team for any questions (sales@innergytech.com, 1-800-203-9015).

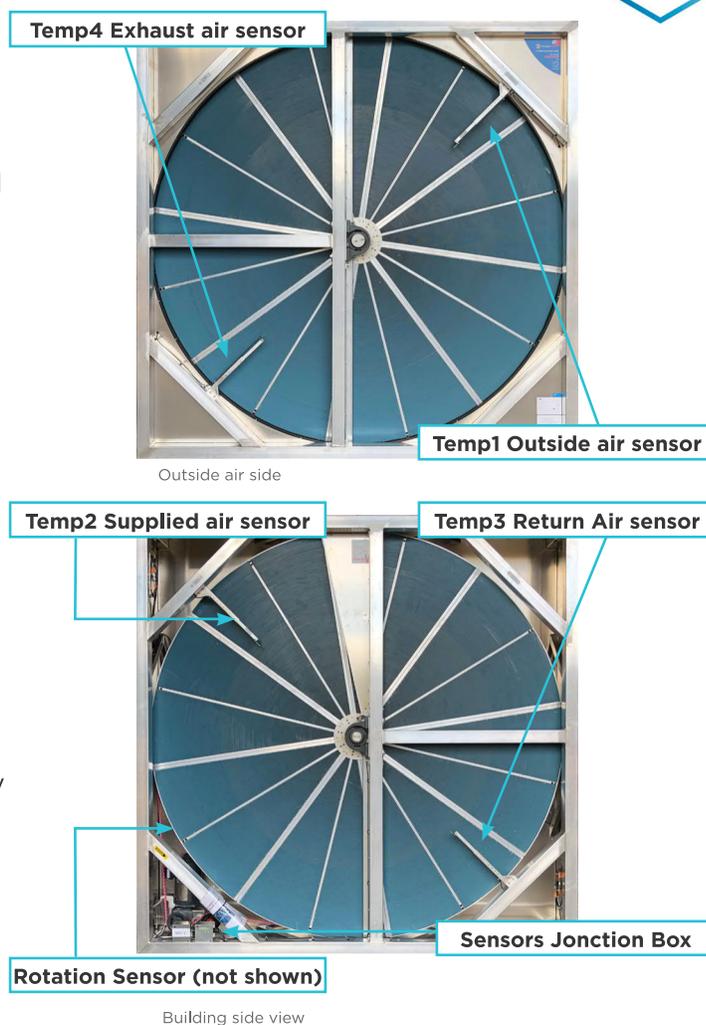


Figure 5



Note: Configuration #5 shown. Please note that sensor locations will vary based on your wheel configuration.



Note: Please refer to your specific wheel drawing for exact sensor locations. With all configurations, Temp1 sensor will always be installed in the Outside air stream, Temp2 sensor in the Supplied air stream, Temp 3 sensor in the Return air stream and Temp4 sensor in the Exhaust air stream.

Overview

- Compact and rugged design
- Customer-specific immersion depth down to 3000 mm
- Precision measurement from -50 ... 250 °C
- Integrated 4 ... 20 mA transmitter or Pt100 output
- Easy process implementation from DN 25 or in tank



Technical data

Performance characteristics

Pt100 accuracy class (EN 60751)	B (± 0.3 °C at 0 °C) $\pm (0.3 + 0.005 \times t)$ °C A (± 0.15 °C at 0 °C) $\pm (0.15 + 0.002 \times t)$ °C 1/3 B (± 0.1 °C at 0 °C) $\pm 1/3 \times (0.3 + 0.005 \times t)$ °C 1/6 B (± 0.05 °C at 0 °C) $\pm 1/6 \times (0.3 + 0.005 \times t)$ °C
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Thermal response time, T50	RTD element only ≤ 1.0 s , conical sensor ≤ 1.3 s , $\varnothing 3$ mm ≤ 2.5 s , $\varnothing 4$ mm ≤ 3.0 s , $\varnothing 6$ mm
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Thermal response time, T90	RTD element only ≤ 3.0 s , $\varnothing 3$ mm ≤ 3.6 s , $\varnothing 4$ mm ≤ 8.5 s , $\varnothing 6$ mm
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Process pressure	Refer to section "Operating conditions"
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Process temperature	Refer to section "Operating conditions"
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Process connection

Connection variants	Refer to section "Dimensional drawings"
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Sensor length	≤ 3000 mm
---------------	----------------

Sensor diameter outside	$\varnothing 6$ mm
-------------------------	--------------------

Mounting position	Any, top, bottom, side
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Standard response tip	$\varnothing 6$ mm
-----------------------	--------------------

Fast response tip	$\varnothing 3$ mm $\varnothing 4$ mm
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Sensor tube material	AISI 316L (1.4404)
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Surface roughness wetted parts	$R_a \leq 0.8$ μ m
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Ambient conditions

Operating temperature range	-40 ... 125 °C , with Pt100 -40 ... 85 °C , with transmitter
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Ambient conditions

Storage temperature range	-55 ... 90 °C
Degree of protection (EN 60529)	IP 65 , with DIN EN 175301-803 A (DIN 43650 A), 4-pin IP 67 , with M12-A, 4-pin
Humidity	≤ 100 % RH , condensing
Long-term test (transmitter)	IEC 770 6.3.2
Vibration (sinusoidal) (EN 60068-2-6)	1.6 mm p-p (2 ... 25 Hz), 4 g (25 ... 100 Hz), 1 octave / min.

Output signal

Without transmitter	1 x Pt100, 4-wire
With transmitter	4 ... 20 mA , 2-wire

Housing

Style	Compact transmitter
Overall size	Refer to section "Dimensional drawings"
Material	AISI 304 (1.4301)

Electrical connection

Connector	DIN EN 175301-803 A (DIN 43650 A), 4-pin M12-A, 4-pin
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Power supply

Voltage supply range	8 ... 35 V DC
Power-up time	< 20 s
Reverse polarity protection	Yes

Factory settings

Output range	0 ... 150 °C
Damping	0 s
Output at sensor fault	23 mA

Compliance and approvals

EMC	EN 61000-6-2 EN 61000-6-3 EN 61326-1 NE21
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Technical data
Compliance and approvals

Hygiene	FDA (21 CFR 177.2415) 3-A (74-07)
Railway applications	EN 50155

Compliance and approvals

Explosion protection	Ex ia Simple apparatus, gas and dust
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Transmitter
Input

Measuring unit	°C °F
Min. measuring span	25 °C
Sample time	< 0.7 s
Accuracy	< 0.25 °C , @ ≤ 100 °C
Repeatability	< 0.1 °C
Resolution	14 bit
Ripple immunity	IEC 770 6.2.4.2
Error detection delay	< 10 s
Offset adjustment	± 10 °C , max.
Isolation, sensor to case	50 V AC , test 500V
Protection	± 35 V DC
Suppression	50 Hz 60 Hz

Output

Output signal	4 ... 20 mA , 2-wire
Accuracy	< 0.1 % , measuring span < 0.016 mA
Temperature drift	< 0.003 %/K , typ. < 0.01 %/K , max.
Resolution	12 bit
Effect of variations in supply voltage	< 0.01 %/V
Ripple immunity	3 Vrms
Shunt resistance	Rs ≤ (V DC - 8 V)/0.023 A
Damping	0.0 ... 30.0 s , programmable
Up/Down scaling limits	23 mA / 3.5 mA

Operating conditions

Ordering key	Process connection	BCID	Process pressure (bar)	Continuous	Process temperature
				Process temperature Standard @ Tamb ≤ 20 °C (° C)	Process temperature With cooling neck @ Tamb ≤ 20 °C (° C)
TE2-#.1.###.###.#	Sleeve Ø 6	T65	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.3.###.###.#	G 1/2 A ISO 228-1	G06	-1 ... 100	-50 ... 125	-50 ... 250
TE2-#.4.###.###.#	G 1/2 A hygienic	A03	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.5.###.###.#	M12 x 1.5 hygienic	A02	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.6.###.###.#	M12 x 1.5 hygienic, with PEEK cone	A02	-1 ... 10	-50 ... 115	N/A
TE2-#.7.###.###.#	G 1/8 female thread hygienic	A01	-1 ... 40	-50 ... 205	-50 ... 250
TE2-#.8.###.###.#	G 1/4 A DIN 3852-E	G50	-1 ... 100	-50 ... 125	-50 ... 250
TE2-#.9.###.###.#	ISO 2852 (Tri-Clamp), DN 33.7; 38, Ø 50.5	C04	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.A.###.###.#	Tri-Clamp Ø 24.9	C01	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.B.###.###.#	BHC 3A DN 38	B01	-1 ... 40	-50 ... 125	-50 ... 250
TE2-#.D.###.###.#	1/2-14 NPT	N02	-1 ... 100	-50 ... 125	-50 ... 250
TE2-#.E.###.###.#	1/4-18 NPT	N01	-1 ... 100	-50 ... 125	-50 ... 250
TE2-#.F.###.###.#	G 1/2 A DIN 3852-E	G51	-1 ... 100	-50 ... 125	-50 ... 250
TE2-#.G.###.###.#					

For further information on permissible process and ambient temperatures, please refer to the operating instructions.

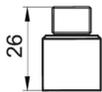
Compliance and approvals

Ordering key	Process connection	BCID	EN 10/2011	EN 1935/2004 EN 2023/2006	FDA	3-A
TE2-#.1.#####.#####.#	Sleeve Ø 6	T65				
TE2-#.3.#####.#####.#	G 1/2 A ISO 228-1	G06				
TE2-#.4.#####.#####.#	G 1/2 A hygienic	A03		■		
TE2-#.5.#####.#####.#	M12 x 1.5 hygienic	A02		■		
TE2-#.6.#####.#####.#	M12 x 1.5 hygienic, with PEEK cone	A02	■	■		■
TE2-#.7.#####.#####.#	G 1/8 female thread hygienic	A01		■		
TE2-#.8.#####.#####.#	G 1/4 A DIN 3852-E	G50				
TE2-#.9.#####.#####.#	ISO 2852 (Tri-Clamp), DN 33.7; 38, Ø 50.5	C04		■		■
TE2-#.A.#####.#####.#	Tri-Clamp Ø 24.9	C01		■		
TE2-#.B.#####.#####.#	BHC 3A DN 38	B01		■		■
TE2-#.D.#####.#####.#	1/2-14 NPT	N02				
TE2-#.E.#####.#####.#	1/4-18 NPT	N01				
TE2-#.F.#####.#####.#	G 1/2 A DIN 3852-E	G51				
TE2-#.G.#####.#####.#						

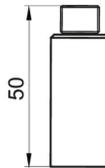
The requirements of the respective 3-A Sanitary Standard will be only fulfilled in combination with appropriate mounting accessories. Those are marked with the 3-A logo.

Dimensional drawings (mm)

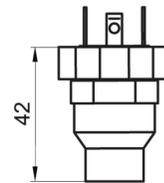
Housing



Housing with connector M12-A, 4-pin



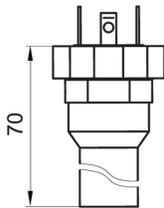
Housing with transmitter and connector M12-A, 4-pin



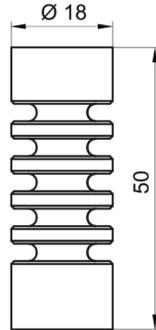
Housing with connector DIN EN 175301-803 A (DIN 43650 A), 4-pin

Dimensional drawings (mm)

Housing

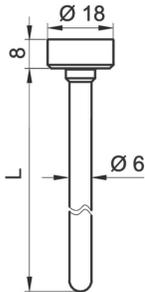


Housing with transmitter and connector DIN EN 175301-803 A (DIN 43650 A), 4-pin

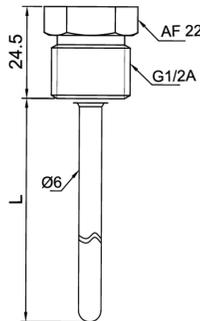


Cooling neck

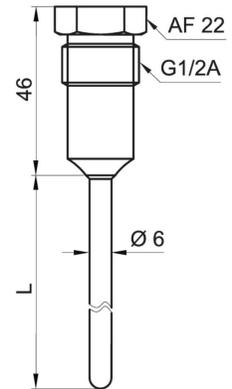
Process connection



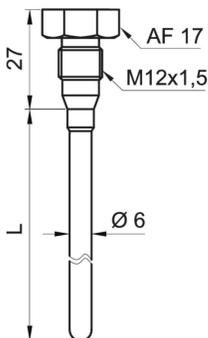
Without thread (BCID: T65)



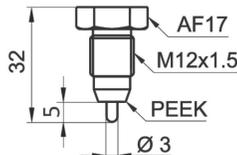
G 1/2 A ISO 228-1 (BCID: G06)



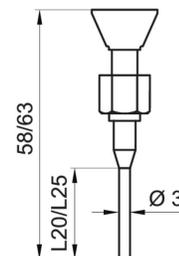
G 1/2 A hygienic (BCID: A03)



M12 x 1.5 hygienic (BCID: A02)



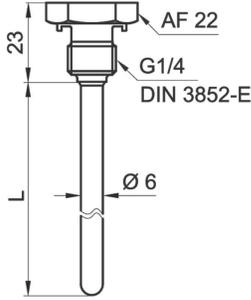
M12 x 1.5 hygienic, PEEK cone, tip Ø 3 x 5 mm (BCID: A02)



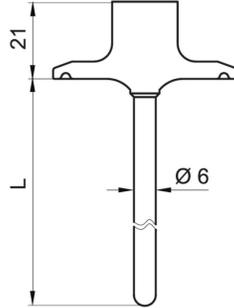
G 1/8 female thread hygienic (BCID: A01)

Dimensional drawings (mm)

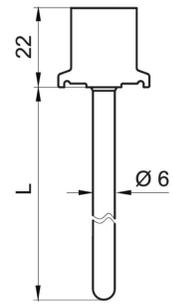
Process connection



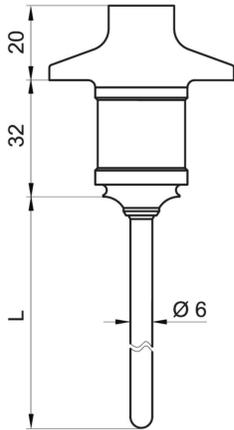
G 1/4 A DIN 3852-E (BCID: G50)



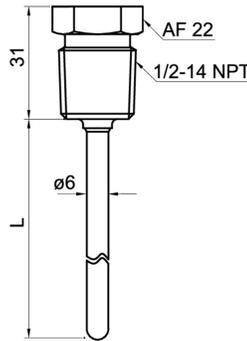
Tri-Clamp Ø 50.5 (BCID: C04)



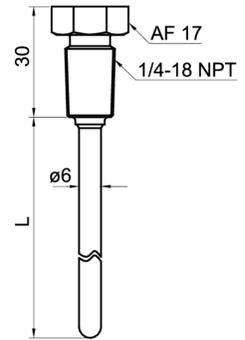
Tri-Clamp Ø 24.9 (BCID: C01)



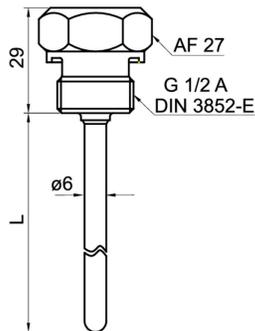
BHC 3A DN 38 (BCID: B01)



1/2-14 NPT (BCID: N02)



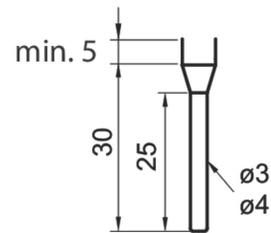
1/4-18 NPT (BCID: N01)



G 1/2 A DIN 3852-E (BCID: G51)



Standard response tip



Fast response tip

Electrical connection

Output type	Electrical connection	Equivalent circuit	Function	Pin assignment									
M12-A, 4-pin, stainless steel													
Pt100 (Single element)			<table border="1"> <tr><td>Pt100 11</td><td>1, 2</td></tr> <tr><td>Pt100 12</td><td>3, 4</td></tr> <tr><td>Frame ground</td><td>Plug thread</td></tr> </table>	Pt100 11	1, 2	Pt100 12	3, 4	Frame ground	Plug thread				
Pt100 11		1, 2											
Pt100 12		3, 4											
Frame ground		Plug thread											
Pt100 (Double element)			<table border="1"> <tr><td>Pt100 11</td><td>1</td></tr> <tr><td>Pt100 12</td><td>4</td></tr> <tr><td>Pt100 21</td><td>2</td></tr> <tr><td>Pt100 22</td><td>3</td></tr> <tr><td>Frame ground</td><td>Plug thread</td></tr> </table>	Pt100 11	1	Pt100 12	4	Pt100 21	2	Pt100 22	3	Frame ground	Plug thread
Pt100 11	1												
Pt100 12	4												
Pt100 21	2												
Pt100 22	3												
Frame ground	Plug thread												
4 ... 20 mA, 2-wire, Iout at pin 2		<table border="1"> <tr><td>+Vs</td><td>1</td></tr> <tr><td>Iout</td><td>2</td></tr> <tr><td>N.C.</td><td>3, 4</td></tr> <tr><td>Frame ground</td><td>Plug thread</td></tr> </table>	+Vs	1	Iout	2	N.C.	3, 4	Frame ground	Plug thread			
+Vs	1												
Iout	2												
N.C.	3, 4												
Frame ground	Plug thread												
4 ... 20 mA, 2-wire, Iout at pin 2, 3		<table border="1"> <tr><td>+Vs</td><td>1</td></tr> <tr><td>Iout</td><td>2, 3</td></tr> <tr><td>N.C.</td><td>4</td></tr> <tr><td>Frame ground</td><td>Plug thread</td></tr> </table>	+Vs	1	Iout	2, 3	N.C.	4	Frame ground	Plug thread			
+Vs	1												
Iout	2, 3												
N.C.	4												
Frame ground	Plug thread												
DIN EN 175301-803 A (DIN 43650 A), 4-pin													
Pt100 (Single element)			<table border="1"> <tr><td>N.C.</td><td>1</td></tr> <tr><td>Pt100 11</td><td>2</td></tr> <tr><td>Pt100 12</td><td>3</td></tr> <tr><td>Frame ground</td><td>Grounding lug</td></tr> </table>	N.C.	1	Pt100 11	2	Pt100 12	3	Frame ground	Grounding lug		
N.C.		1											
Pt100 11		2											
Pt100 12	3												
Frame ground	Grounding lug												
4 ... 20 mA, 2-wire		<table border="1"> <tr><td>+Vs</td><td>1</td></tr> <tr><td>Iout</td><td>2</td></tr> <tr><td>N.C.</td><td>3</td></tr> <tr><td>Frame ground</td><td>Grounding lug</td></tr> </table>	+Vs	1	Iout	2	N.C.	3	Frame ground	Grounding lug			
+Vs	1												
Iout	2												
N.C.	3												
Frame ground	Grounding lug												

Ordering information

Ordering key - Configuration possibilities see website

Product	TE2	-	#	.	#	.	#	#	#	.	####	.	#
Sensor tip	TE2												
Not specified											0		
Standard response tip, Ø 6 mm											1		
Fast response tip, Ø 4 mm											2		
Fast response tip, Ø 3 mm											3		

Ordering information
Ordering key - Configuration possibilities see website

	TE2	-	#	.	#	.	#	#	#	.	####	.	#
Process Connection													
Tube without connection													1
G 1/2 A ISO 228-1 (G06)													3
G 1/2 A hygienic (A03)													4
M12 × 1.5 hygienic (A02)													5
M12 × 1.5 hygienic, PEEK cone, sensor tip Ø 3x5 mm (A02)													6
G1/8 ISO 228/1 female thread, Hygienic (A01)													7
G 1/4 A DIN 3852-E, with NBR seal (G50)													8
ISO 2852 (Tri-Clamp), DN 25; 33.7; 38, Ø 50.5 (C04)													9
DIN 32676-C (Tri-Clamp), DN 3/4, Ø 24.9 (C01)													A
BHC 3A DN 38 (B01)													B
1/2-14 NPT (N02)													D
1/4-18 NPT (N01)													E
G 1/2 A DIN 3852-E, with FKM seal (G51)													F
G 1/2 A DIN 3852-E, with EPDM seal (G51)													G
Sensor element													
1/1 B EN 60751, single													1
1/1 B EN 60751, duplex													2
1/3 B EN 60751, single													3
1/3 B EN 60751, duplex													4
1/6 B EN 60751, single													5
1/6 B EN 60751, duplex													6
1/1 A EN 60751, single													7
1/1 A EN 60751, duplex													8
Cooling neck													
Without cooling neck													0
With cooling neck													4
Electrical connection													
M12-A, 4-pin, stainless steel													1
M12-A, 4-pin, stainless steel, with integrated transmitter													2
DIN EN 175301-803 A (DIN 43650 A), 4-pin ⁽¹⁾													4
DIN EN 175301-803 A (DIN 43650 A), 4-pin, with integrated transmitter ⁽¹⁾													5
M12-A, 4-pin, stainless steel, with integrated transmitter, Iout pin 2+3													A
Certificates													
Not specified													0
Railway EN 50155													4
Ex ia Simple apparatus, gas and dust													9
Sensor tube length (mm)													
5 - 3000													####
Configuration													
No configuration													0
Configuring according to customer specification													C

(1) Including female power connector



6. INSTALLATION SPECIFICATIONS

6.1 Installation environment

Install the drive in an environment matching the specifications below to help prolong its optimum performance life.

ENVIRONMENT CONDITIONS	CONDITIONS
Installation Area	Indoors
Ambient temperature	NEMA 1 & 12 Enclosures: -15 to +50°C (5 to 122°F). 0 to -15°C (32 to 5°F) : Not frost allowed. Output derated above +40°C (104°F) NEMA 3R with heater: Same except for minimum temperature down to -40°C/F
Humidity	5 to 95% No condensation allowed Maximum relative humidity is 60% in the presence of corrosive gasses
Storage temperature	-40 to +70°C (-40 to +158°F)
Surrounding area	Install the drive in an area free from: <ul style="list-style-type: none">• Oil mist and dust• Metal shavings, oil, water, or other foreign materials• Radioactive materials• Combustible materials (e.g., wood)• Harmful gases and liquids• Excessive vibration• Chlorides• Direct sunlight
Altitude	0 to 4000 m (13123 ft) Above sea level Output derated above 1000 m (3281 ft)
Vibration	Risk category IV Certified (IBC 2015)
Orientation	Install the drive vertically to maintain maximum cooling effects
Atmospheric pressure	70 to 106 kPa (10.2 to 15.4 PSI) 0.7 to 1.05 atmospheres



Notes: 1. Avoid placing drive peripheral devices, transformers, or other electronics near the drive as the noise created can lead to erroneous operation. If such devices must be used in close proximity to the drive, take proper steps to shield the drive from noise.

2. Prevent foreign matter such as metal shavings and wire clippings from falling into the drive during installation. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before drive start-up, as the cover will reduce ventilation and cause the drive to overheat.



6. INSTALLATION SPECIFICATIONS

6.2 Drive Package Specifications

ABB Drive Model	Voltage	Hertz	Max Motor HP	Amperage	Minimum Wire Size
ACH580-01-04A6-2	208-230	60	1	4.6A	14 AWG
ACH580-01-02A1-4	460	60	1	2.1A	14 AWG
ACH580-01-02A7-6	600	60	2	2.7A	14 AWG

6.3 Local mode jumper

Your new ABB ACH580 VFD package comes with a local jumper that should be installed between the START and +24 terminals when using the local mode of the drive (as shown below). Note that the drive **WILL NOT WORK** in local mode if this jumper is not installed.

This jumper **SHOULD NOT BE INSTALLED** if using the drive in remote mode (when wiring the drive to a building management system). Instead, a dry contact relay should be installed and may be used for the drive remote start/stop feature.

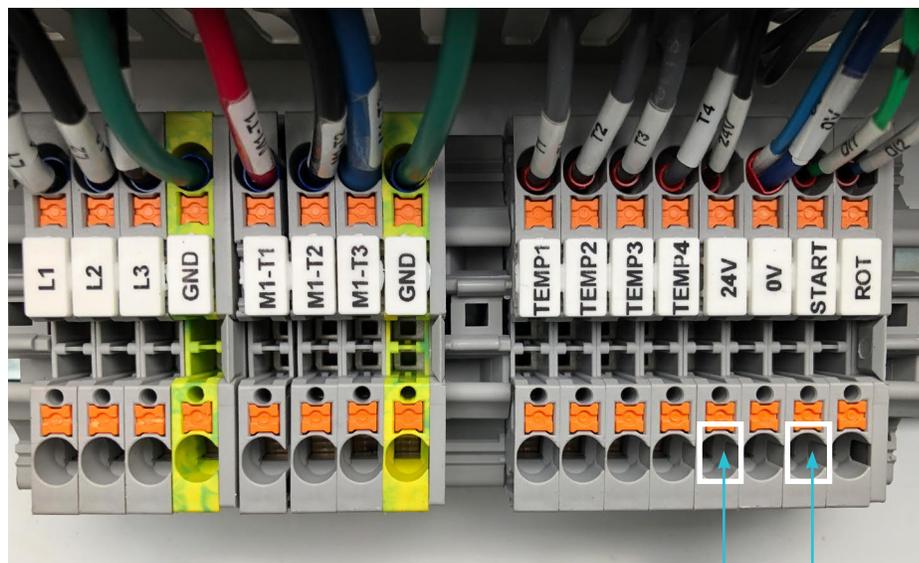
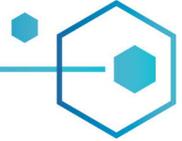


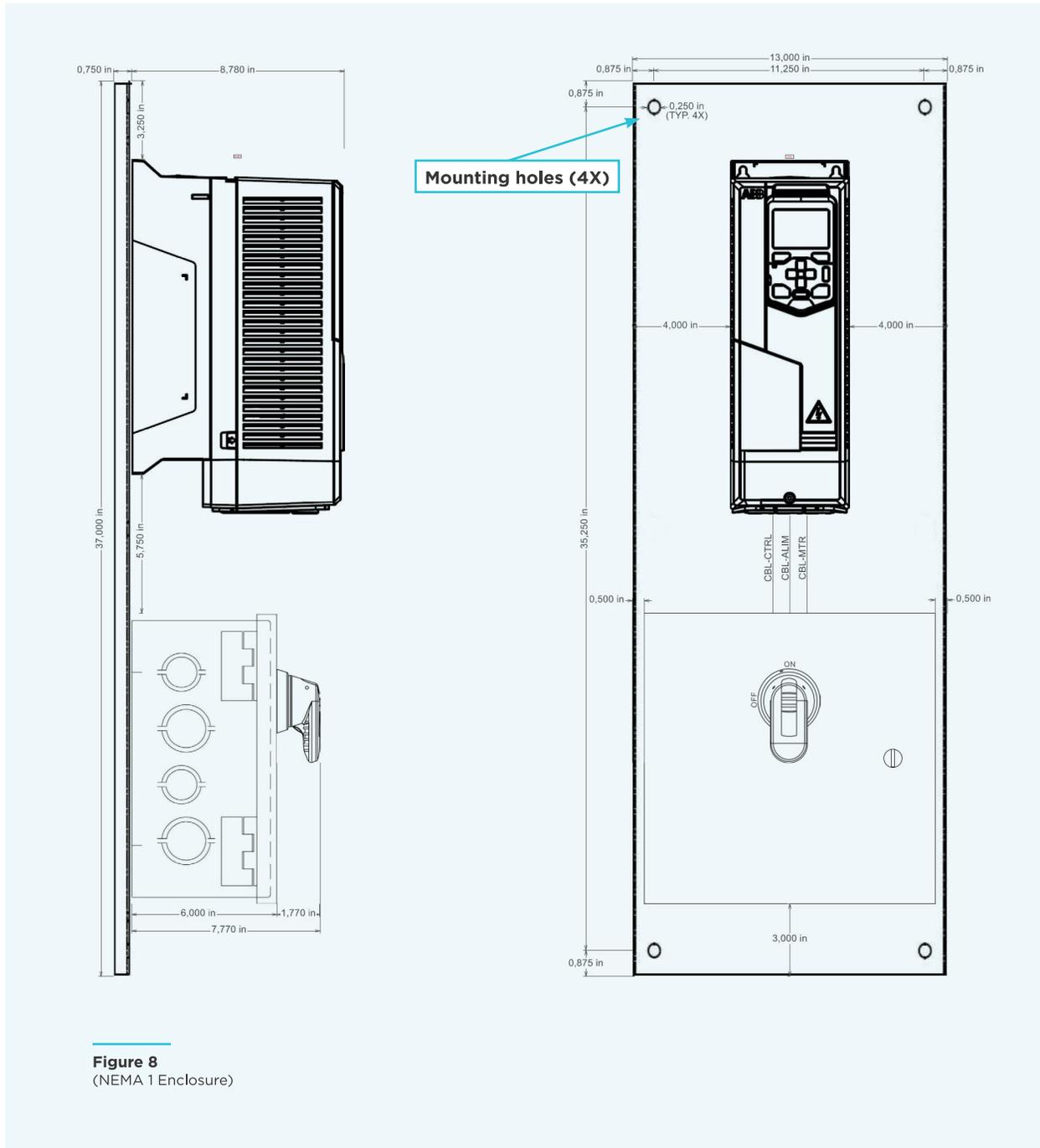
Figure 7

Jumper (local mode) or Relay for Start/Stop operations (remote mode)

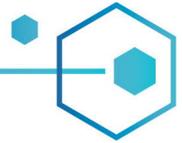


6. INSTALLATION SPECIFICATIONS (CONT'D)

6.4 VFD Dimensions



Note: Dimensions shown are in inches.



6.4 VFD Dimensions

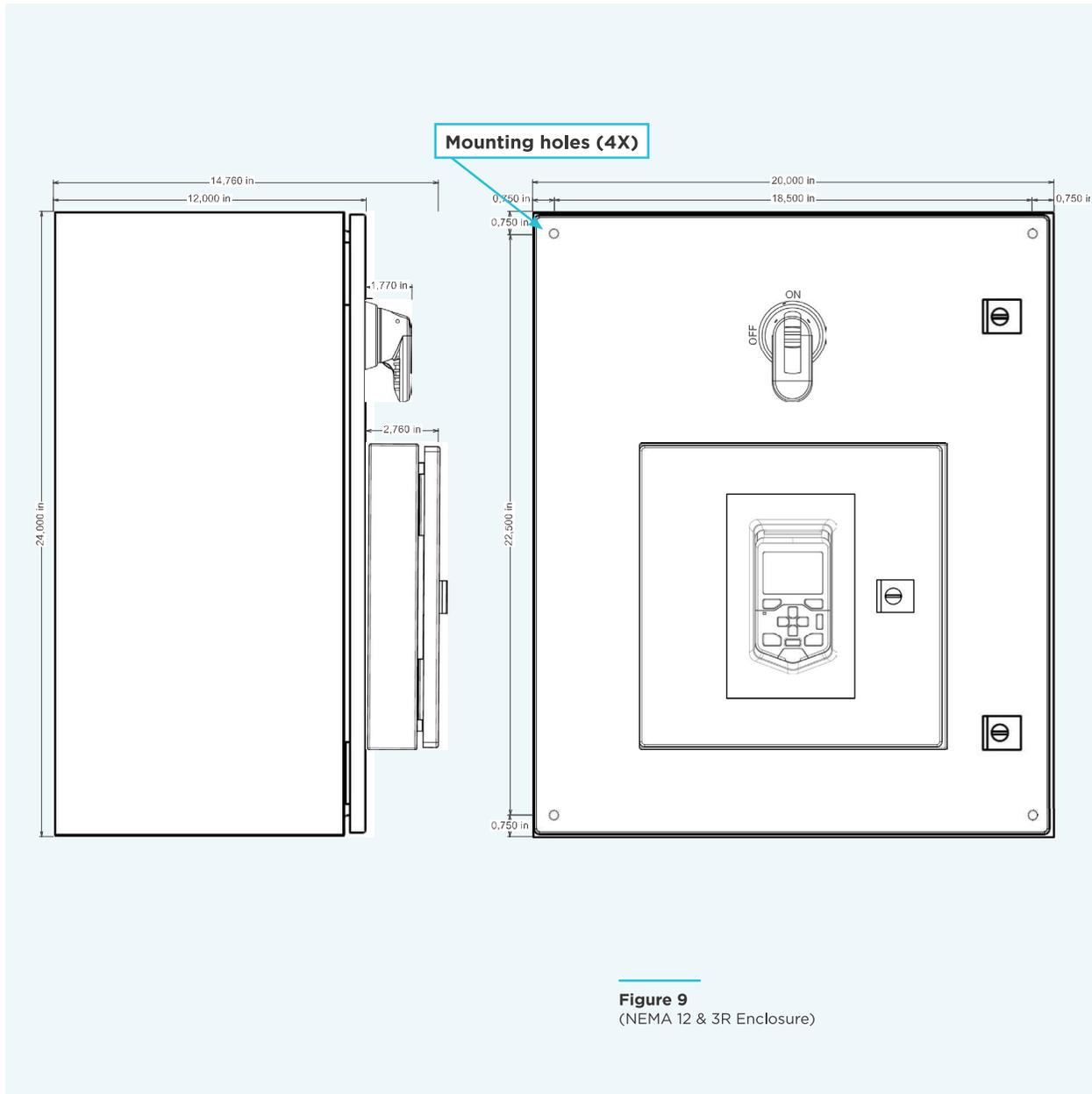
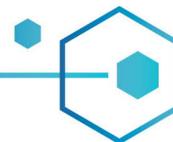


Figure 9
(NEMA 12 & 3R Enclosure)



Note: Dimensions shown are in inches.

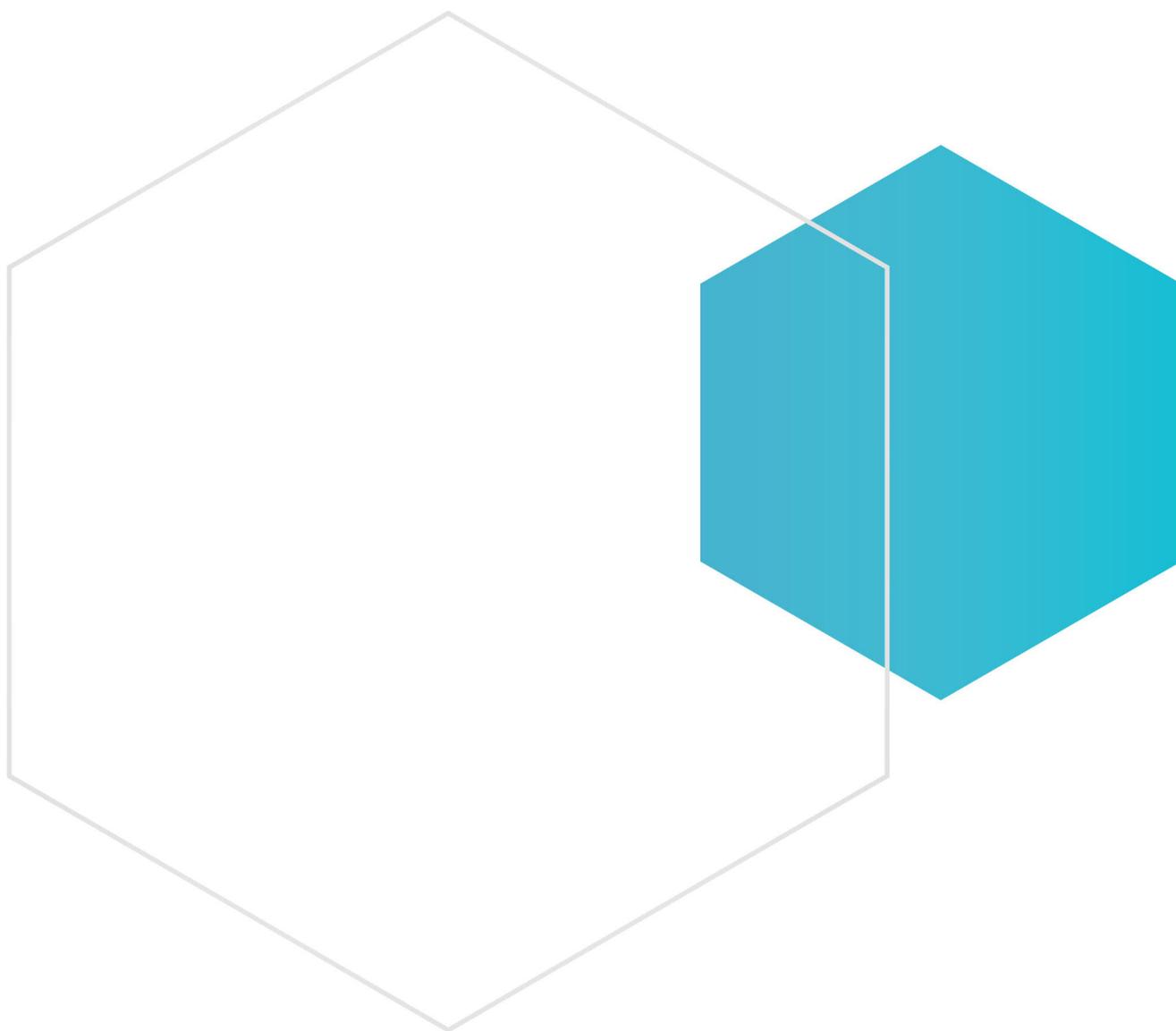


7. MOTORS AND INPUT CURRENTS

Our ABB ACH 580 VFD Controller package was designed for our i4 energy recovery wheel standard motors of 1/2HP or 1HP, 208/230/460 or 575 volts and 3 phases input currents.

240 volts, 1 phase current can also be transferred by the VFD package into 208 volts, 3 phases current. Please contact Innergy tech's technical sales team for any questions or other input currents.

IMPORTANT: Note that a motor inverter constant of at least 1000:1 is needed in order to ensure equal torque values for all rotation speeds.





8. VFD CONTROLLER REGISTER GUIDE

VFD CONTROLLER OUTPUTS				
Description	Unit	LCD Panel	Modbus	BACnet MS/TP
Temperature sensor 1	°F	47,01	404701	AV124
Temperature sensor 2	°F	47,02	404702	AV125
Temperature sensor 3	°F	47,03	404703	AV126
Temperature sensor 4	°F	47,04	404704	AV127
Speed of the wheel	RPM	1,01	400101	AV0
Rotation Sensor Warning	N/A	4,06	400406	MSV4
Mode of Wheel ¹	INT	7,31	400731	AV122
Real Time Temperature Efficiency ²	%	47,22	404722	AV129
FREE COOLING/ECONOMISER & FROST CONTROL SETPOINTS				
Description	Unit	LCD Panel	Modbus	BACnet MS/TP
Free cooling (Default: 60°F)	°F	47,12	404712	AV121
Frost prevention (Default: 34°F) ³	°F	47,11	404711	AV120
OTHER VFD CONTROLLER INPUTS				
Description	Unit	LCD Panel	Modbus	BACnet MS/TP
Remote Start/Stop Command ⁴	0(STOP) or 1(START)	N/A ⁵	404713	AV123
Rotation sensor mode ⁶	0 (Rotation Sensor Inactive) or 1(Rotation Sensor Active)	47,22	N/A	N/A
VFD ERROR CODES ⁷				
Error Codes	Cause	LCD Panel Code	Modbus	BACnet MS/TP
Signal Supervision 1	Temperature Sensor 1 Alarm	A8B0	400406	MSV4
Signal Supervision 2	Temperature Sensor 2 Alarm	A8B1	400406	MSV4
Signal Supervision 3	Temperature Sensor 3 Alarm	A8B2	400406	MSV4
Signal Supervision 4	Temperature Sensor 4 Fault	80B3	400401	MSV1
External Warning 1	Rotation Sensor Fault	A981	400406	MSV4
Overload	Drive Overload	AE01	400401	MSV1
Other Codes	See ABB ACH580 Manual			
MANUAL SPEED INPUT (THROUGH MODBUS OR BACNET)				
Step 1: Speed setting ⁸	%	N/A ⁵	400002	AV16
Step 2: Control Manual ⁹	EXT1(PID SPEED) or EXT2 (Speed selected in Step 1)	N/A ⁵	401911	BV13
Step 3: Start	0(STOP) or 1(START)	N/A	400001	BV10
MANUAL SPEED INPUT (0-10VOLTS ANALOG INPUT) ¹⁰				
Step 1	Change the analog signal type: 12.15 set to V			
Step 2	Disable adaptive program: 96.70 set to YES			
Step 3	Ext1 in 1: 20.03 set to D11			
Step 4	RO1 Source: 10.24 set to Not Energized			
Step 5	Minimum Input range selection RPM: 12.19 set to 0			
Step 6	Maximum Input range selection RPM: 12.20 set to 1720			
Step 7	Speed Reference address N/A 22.11: Set to AI1 scaled			

¹ Modes are Frost Control(1), Free Cooling (2, less than 100% speed), heating (2, 100% speed) and Cooling (3).

² Does not consider unbalanced airflows.

³ **CAUTION:** Frost damage may occur, please contact Innery tech Technical support before changing this value.

⁴ Also possible with a relay installed between START and +24V terminals. See section XX for more details.

⁵ Through local mode button.

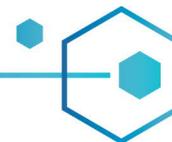
⁶ Active mode only available with our optional rotation sensor kit.

⁷ See trouble shooting section XX for more details.

⁸ Speed input in percentage (Minimum 1.25% = 1/4RPM to Maximum 100% = 20RPM)

⁹ **CAUTION:** Manual speed control will give you direct control over the rotation speed of the wheel and disable the Innery tech built-in program. Innery tech will not be responsible for any damage resulting from an improper frost control sequence.

¹⁰ Once done the signal should be wired to the TEMP1 and OV terminals.



10. INNERGY TECH VFD CONTROLLER SOFTWARE

10.1 Temperature conversion

While the ABB 580 controller package will automatically convert its mA analog input to °F for the user, if mA VS °F verifications become necessary for troubleshooting purpose, the following information should be used.

	RANGE	
	Min.	Max.
Sensor Output	4mA	20mA
↓	↓	↓
Temperature	-40°F	122°F

From this matrix, we can propose the following formula to convert temperature into mA and the opposite:

$$T = 10.125 * mA - 80.5$$

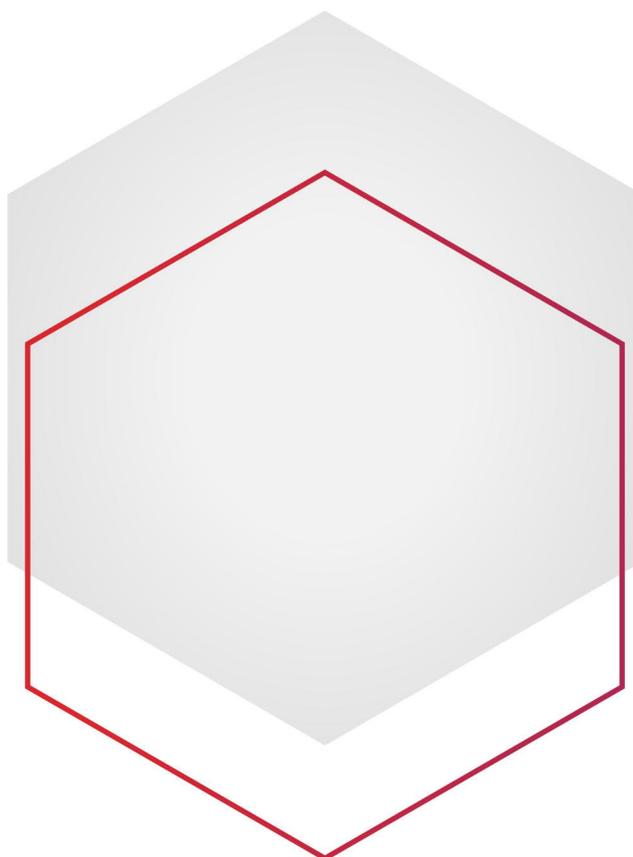
$$mA = (T + 80.5) / 10.125$$

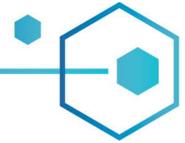
Where T = Temperature in °F
mA = Milliamps Sensor Output

10.2 Wheel speed conversion

The software running inside the VFD controller is using a percentage scale to settle the drive frequency output. This frequency is directly related to the wheel speed as shown in the matrix below.

	RANGE	
	Min.	Max.
VFD Controller Software	1.25%	100%
↓	↓	↓
Frequency	0.75 Hz	60 Hz
↓	↓	↓
Wheel RPM	0.25 RPM	20 RPM





11. WIRING DIAGRAMS

11.1 Drive to wheel connections



WARNING: Electrical connections must be performed only by qualified personnel, and comply with all local and national codes and ordinances.

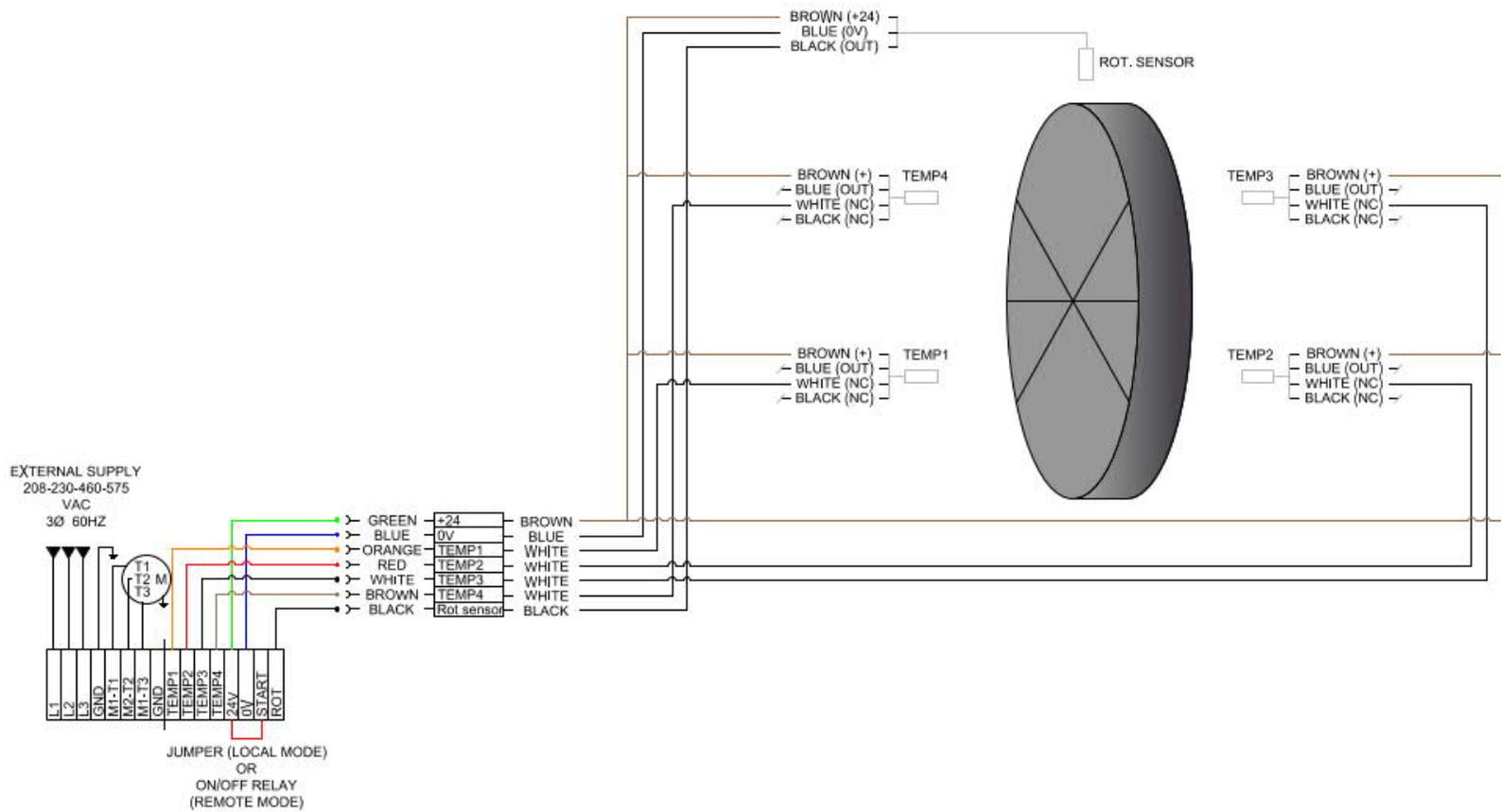
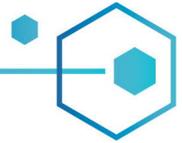


Figure 10



11. WIRING DIAGRAMS (CONT'D)

11.2 Drive internal connections

1. VFD Inputs/Outputs wiring

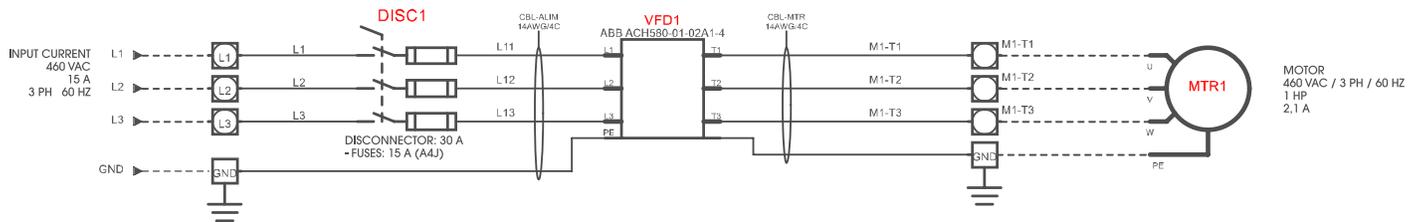


Figure 11

2. VFD Internal wiring

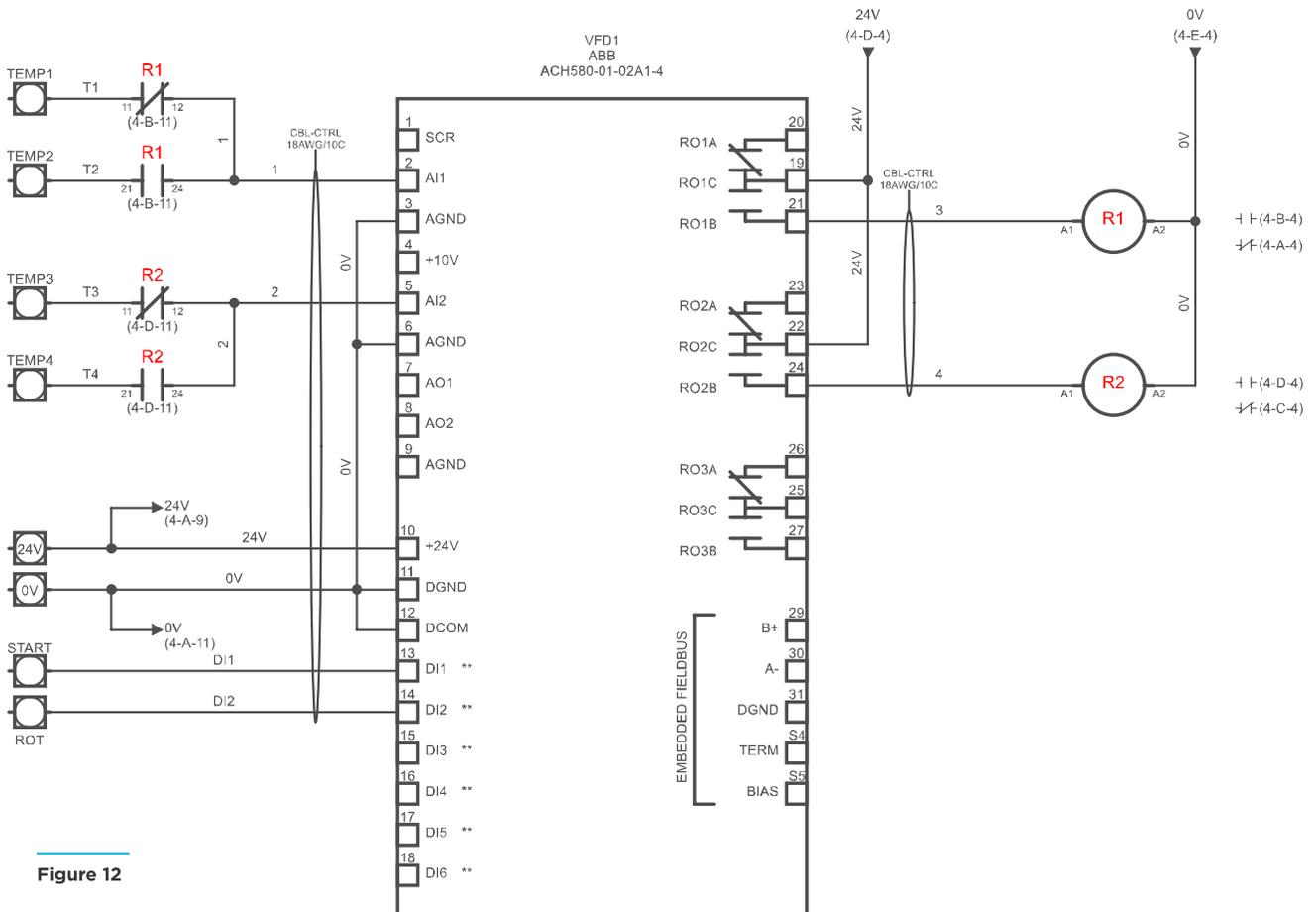
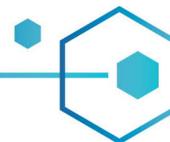


Figure 12



12. TROUBLESHOOTING

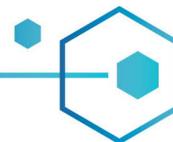


WARNING: Electric shock hazard: Before performing maintenance or servicing, always disconnect the unit from its power source.



CAUTION: Any work on the electric wires and control panel should be performed by a qualified electrician.

Issue	Possible causes	Solutions
LCD Panel Error Code A8B0, Signal Supervision 1, Modbus Code 400406 or BACnet code MSV4. Error Code: Internal Warning.	TEMP1 Sensor fault (miswired)	1)Verify TEMP1 sensor connections per the VFD wiring diagram. 2)Make sure TEMP1 sensor is really the one wired to the TEMP1 location. 3)Make sure the wires are not damaged or cut.
LCD Panel Error Code A8B1, Signal Supervision 2, Modbus Code 400406 or BACnet code MSV4. Error Code: Internal Warning.	TEMP2 Sensor fault (miswired)	1)Verify TEMP2 sensor connections per the VFD wiring diagram. 2)Make sure TEMP2 sensor is really the one wired to the TEMP2 location. 3)Make sure the wires are not damaged or cut.
LCD Panel Error Code A8B2, Signal Supervision 3, Modbus Code 400406 or BACnet code MSV4. Error Code: Internal Warning.	TEMP3 Sensor fault (miswired)	1)Verify TEMP3 sensor connections per the VFD wiring diagram. 2)Make sure TEMP3 sensor is really the one wired to the TEMP3 location. 3)Make sure the wires are not damaged or cut.
LCD Panel Error Code A8B3, Signal Supervision 4, Modbus Code 400401 or BACnet code MSV1. Error Code: External Fault.	TEMP4 Sensor fault (miswired)	1)Verify TEMP4 sensor connections per the VFD wiring diagram. 2)Make sure TEMP4 sensor is really the one wired to the TEMP4 location. 3)Make sure the wires are not damaged or cut.
LCD Panel Error Code A981, External Warning 1, Modbus Code 400406 or BACnet code MSV4. Error Code: Internal Warning.	Rotation Sensor Alarm (miswired)	1)Verify the rotation sensor connections per the VFD wiring diagram. 2)Make sure the wires are not damaged or cut.
	Rotation Sensor Alarm (wheel stopped turning)	1)With the wheel stopped, verify it can turn freely by hand and that nothing prevents its rotation. 2)Ensure the drive mechanism is in good working order (proper belt tension or contact between the wheel rotor and contact wheel).
	Rotation sensor failure or failed detection	1)Verify that the distance between the rotation detector and its magnet does not exceed 1". 2)Make sure the magnet is still in place within the rotor.
The power is on but the wheel does not start.	Local mode jumper not installed or open relay	1)If using the drive in local mode, verify a jumper is installed between the START and +24V terminals. 2)If using a relay for remote start/stop, verify the relay is in the closed or start position and that its connected to the START and +24V terminals. Alternatively, the relay can be removed and a jumper installed instead to make sure the relay is not the issue.
	TEMP4 Sensor fault (miswired) Error Code: External Fault.	1)Verify TEMP4 sensor connections per the VFD wiring diagram. 2)Make sure TEMP4 sensor is really the one wired to the TEMP4 location. 3)Make sure the wires are not damaged or cut.
The wheel is turning in the wrong direction (opposite to the rotation arrows).	Some of the motor wire connections are inverted.	1)Invert the wires of two phases on the three-phase motor (see Section 11.2 VFD Inputs/Outputs wiring).
The drive remains at 60Hz.	The frost control or freecooling setpoints were changed and do not use the correct values.	1)Verify that the frost control setpoint is set to the correct value (Default: 34°F). Can be adjusted with parameter 47.11 2)Verify that the free cooling setpoint is set to the correct value (Default: 60°F). Can be adjusted with parameter 47.12



GLOSSARY

Following are terms used throughout this manual that you need to become familiar with. Note that many of these terms are covered in more details throughout the many sections of this manual.

ENERGY RECOVERY WHEEL (ERW): Device that exchanges sensible and latent energy. As the ERW rotates between the outdoor and return airstreams, the higher temperature and more humid airstream transfers its sensible and latent energy to the coated aluminum. That energy is then released to the cooler and/or dryer airstream during the second half of the revolution.

ROTOR: Term used to describe the spokes and media assembly that turns and transfers sensible or sensible and latent energies.

BUILDING MANAGEMENT SYSTEMS (BMS): Computer-based control systems installed in buildings that control and monitor the building's mechanical and electrical equipment such as ventilation, lighting, power systems, fire systems, and security systems.

CONTROLLER: Electronic device that receives the sensors' outputs, analyze them based on a pre-established program and send an analog output to the VFD. The ABB ACH 580 VFD Controller package uses a VFD with a built-in controller.

VARIABLE FREQUENCY DRIVE (VFD): Electronic device that controls AC motor speed and torque by varying the motor's input frequency.

FROST CONTROL: Part of the control that prevents ice formation within the energy recovery wheel's media.

FROST CONTROL SETPOINT: Exhaust air (TEMP4) minimum dry bulb acceptable temperature before the speed of the wheel is reduced. Controller package will modulate the speed of the wheel to prevent the exhaust air from decreasing below the frost control setpoint.

FREE COOLING (ECONOMIZER): Part of the control that prevents overheating the building for cool outdoor air (TEMP1) conditions.

FREE COOLING SETPOINT: Supplied air (TEMP2) maximum dry bulb acceptable temperature when outside air (TEMP1) is cooler than the return air (TEMP3). Controller package will modulate the speed of the wheel to prevent the supplied air from exceeding the free cooling setpoint.

SUMMER CHANGEOVER: Defined as the automatic change of the ERW controller between heating or free cooling modes and cooling mode.

COOLING MODE: Energy recovery mode, with wheel operating at 100% capacity, when outside air (TEMP1) is warmer than the return air (TEMP3).

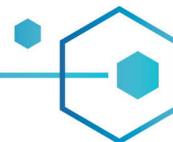
HEATING MODE: Energy recovery mode, with wheel operating at 100% capacity, when outside air (TEMP1) is colder than the return air (TEMP3).

OUTDOOR AIR STREAM (TEMP1): Fresh air that is brought in from the outside. This air goes through the ERW and then is ducted into the building.

SUPPLIED AIR STREAM (TEMP2): Air that is brought in from the outside, has passed through the ERW and is ducted into the building.

RETURN AIR STREAM (TEMP3): Stale air from the building that is being ducted to the ERW.

EXHAUST AIR STREAM (TEMP4): The return indoor air that has passed through the ERW. This air is being ducted outdoors.



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