



EL-FI M20
SHAFT POWER MONITOR
INSTRUCTION MANUAL
Motor Shaft Output Power
Measurement
Manual Version US1.02

1

Emotron M20 Load Monitor Wiring Schematics

3 Φ Motor Wiring Diagram (< 100 Amp FLA)

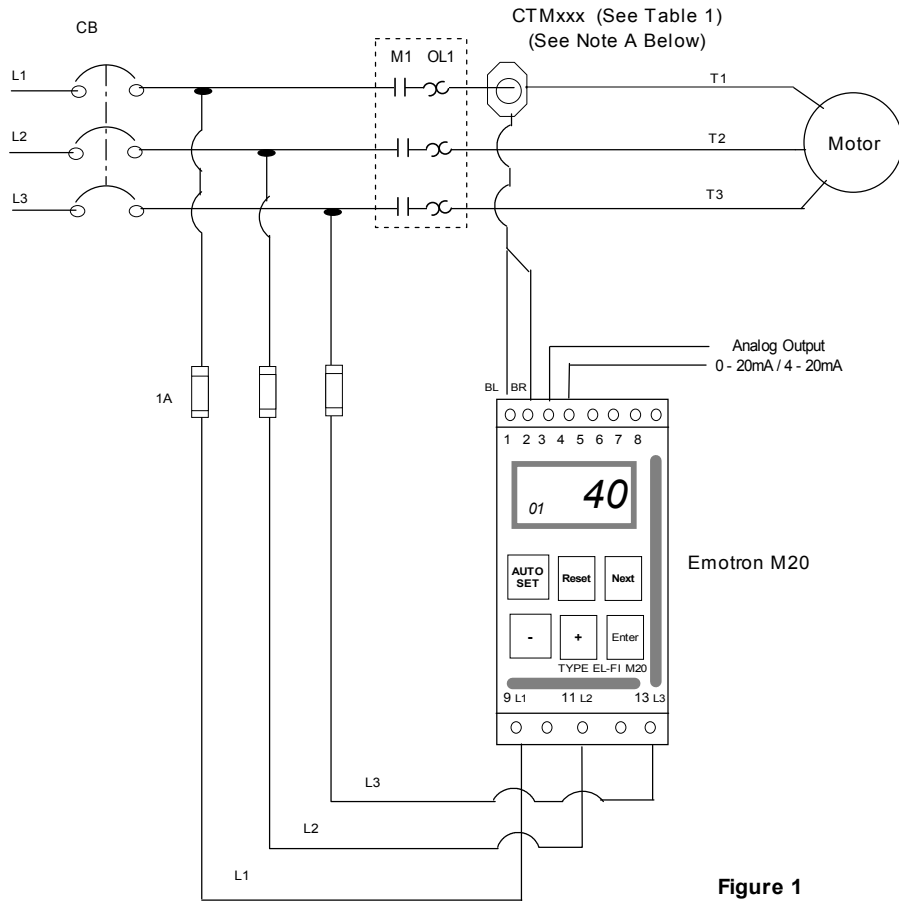


Figure 1

Table 1

Motor FLA	Current Transformer Secondary Windings			
	CTM 10	CTM 25	CTM 50	CTM 100
0.4 - 1.0	10			
1.01 - 2.0	5			
2.01 - 3.0	3			
3.01 - 5.0	2			
5.1 - 10.0	1			
10.1 - 12.5		2		
12.6 - 25		1		
26.0 - 50.0			1	
51.0 - 100.0				1

NOTE A.

The Current Transformer (CTMxxx) Must be installed in the same phase that is connected to Terminal 9 on the M20

3 Φ Motor Wiring Diagram (> 100 Amp FLA)

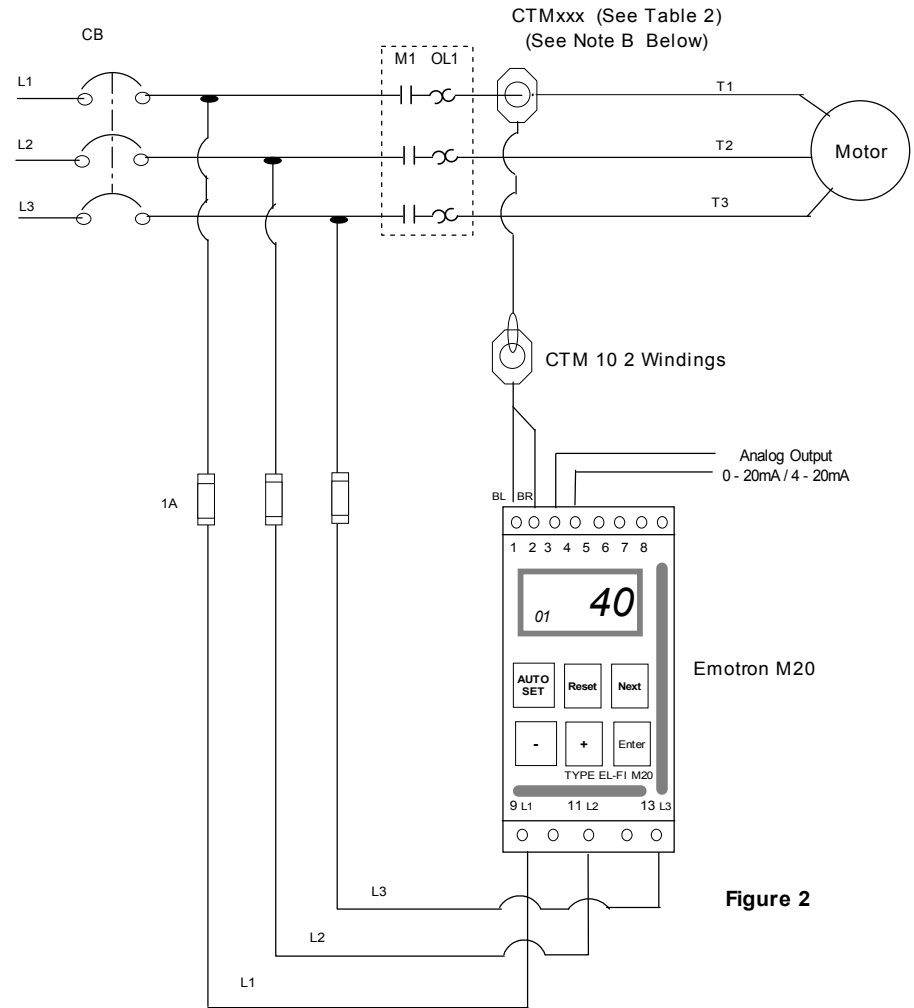


Figure 2

Table 2

Motor FLA	CTM 10	Current Transformer Secondary Windings			
		CTM 150:5	CTM 250:5	CTM 500:5	CTM 1000:5
101 - 150	2+	1			
151 - 250	2+		1		
251 - 500	2+			1	
501 - 999	2+				1

NOTE B.

The Primary Current Transformer (CTMxxx) Must be installed in the same phase that is connected to Terminal 9 on the M20

Emotron M20 Load Monitor Wiring Schematics

1 Φ Motor Wiring Diagram (< 100 Amp FLA)

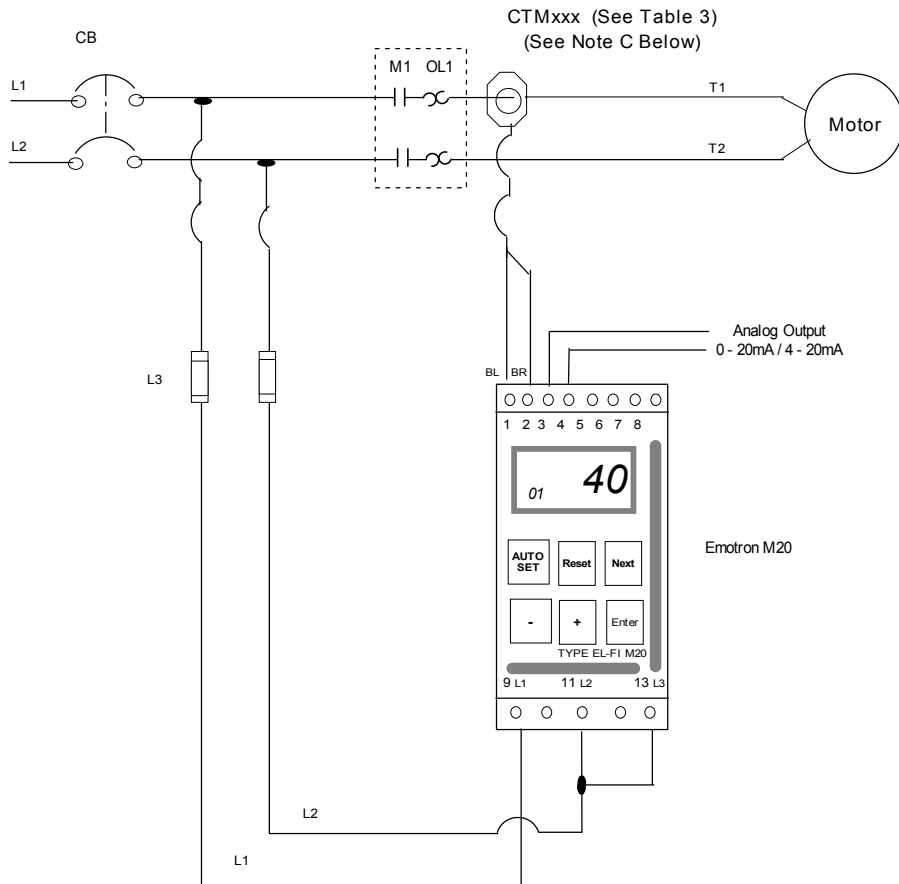


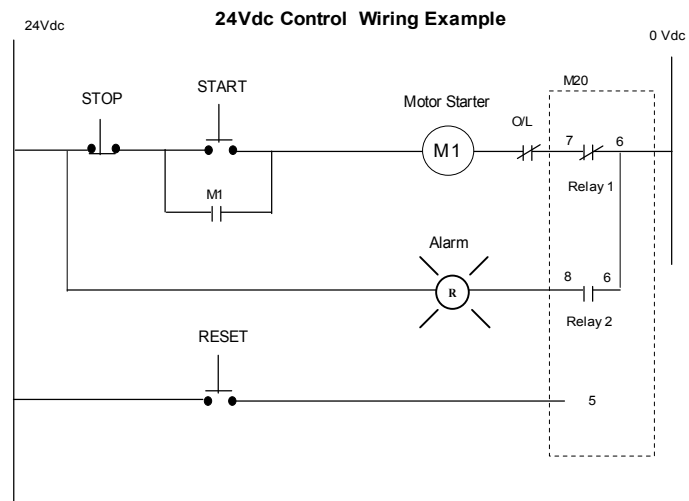
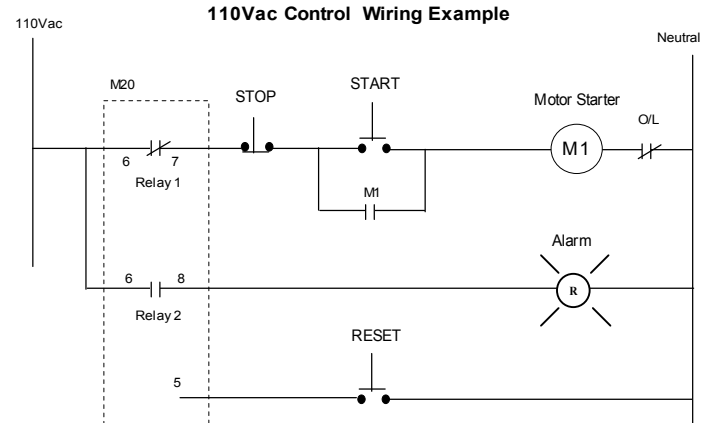
Table 3

Motor FLA	Current Transformer Secondary Windings			
	CTM 10	CTM 25	CTM 50	CTM 100
0.4 - 1.0	10			
1.01 - 2.0	5			
2.01 - 3.0	3			
3.01 - 5.0	2			
5.1 - 10.0	1			
10.1 - 12.5		2		
12.6 - 25		1		
26.0 - 50.0			1	
51.0 - 100.0				1

NOTE C.

The Primary Current Transformer (CTMxxx) Must be installed in the same phase that is connected to Terminal 9 on the M20

Control Wiring Examples



NOTES

1. Terminal 6 is the common for both Relay 1 and Relay 2
2. Relays 1 and 2 are individually programmable as N/O or N/C. See parameters 63 and 64
3. Main Alarm Relay 1 (terminal 7) can be set as 'latching' or 'non-latching'. see parameter 61
4. Digital I/P 1 (terminal 5) is active when terminal 5 is switched to common rail associated with terminal 6

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Initial Setup of Equipment

The following Procedure will setup the M20 Parameters for the majority of applications. For a more detailed setup please review the M20 Manual and/or contact Emtron Inc. @ 419 841 7774 and ask for Technical Support.

Step 1.

Installation Check

This step is critical. 90% of problems reported during M20 commissioning relate to the following installation error.

The CTM Must be installed in the same phase which is connected to terminal 9.

If this is not the case then the calculated load will either be incorrect or will be zero.

Check to make sure that the CTM is in the correct phase.



Step 2.

Unit of Measurement

The recommended setting is % HP especially for small motors

Display Window 01  Default Value %KW

Settings KW, % KW, HP or % HP




Hold  and  for 3 Seconds, display will change to HP. Repeat for %HP



Step 3.


Overload and /or Underload. Select required unit operation

This parameter is dependant upon the application

Display Window 05  Default Value  Overload and Underload

Settings  Overload (+ Pre Alarm)  Underload (+ Pre Alarm)
 Overload and Underload (+ Pre Alarms)

Press  or  until desired operation reached


Press  to accept new value

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Step 4.

Motor Start Inrush Current Time (Delay to allow motor to start before arming alarms)

Ensure that this time is long enough to cover the motor start but not too long

Display Window 31  Default Value 2.0 Seconds

Settings 1 - 999 Seconds

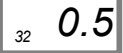
Press  or  until desired value reached

Press  To Accept New Value

Step 5.


Alarm relay response delay

A short delay could result in nuisance alarms. A long delay could result in process damage

Display Window 32  Default Value 0.5 Seconds

Settings 0.1 - 90 Seconds

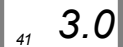
Press  or  until desired value reached

Press  to accept new value



Step 6.


Rated Motor Power (from motor nameplate)

For Accurate monitoring ensure the correct data is obtained from the motor nameplate

Display Window 41  Default Value 3 HP

Settings 0.13 - 999 HP

Press  or  until desired value reached

Press  to accept new value

Page 6



Step 7.


Rated Motor FLA (from motor nameplate)

For accurate monitoring ensure the correct data is obtained from the motor nameplate

Display Window 42 42 5.6 Default Value 5.6 Amps

Settings 0.01 - 999 Amps

Press  or  until desired value reached



Press  to accept new value


Step 8.

Set Number Of Phases (single or three phase depending on the motor)

Display Window 43 43 3PH Default Value 3PH

Settings 1PH 3PH

Press  or  until desired Setting reached



Press  to accept new value


Step 9.

Main Alarm Relay R1 (Latched (reset required) or Unlatched (no reset required))

Display Window 61 61 OFF Default Value OFF

Settings OFF (Unlatched) ON (Latched)

Press  or  until desired operation reached



Press  to accept new value


Step 10.

Main Alarm Relay R1 (programmable - normally open / normally closed)

Display Window 63 63 nc Default Value nc

Settings nc no

Press  or  until desired operation reached



Press  to accept new value


Step 11.

Pre- Alarm Relay R2 (programmable - normally open / normally closed)

Display Window 64 64 no Default Value no

Settings nc no

Press  or  until desired operation reached

Press  to accept new value

3

Final Setup

The following Procedure will setup the Alarm Levels for the M20 relative to the normal load displayed in window 01

Step 12.

Start the motor to be monitored

Display Window 01

01 65

Window 01 will display the monitored motor % HP and a start timer (as parameter 31 times out)

01 22

On completion of the start delay. Window 01 will display 'Shaft Power'

Step 13.

Auto Set Parameters

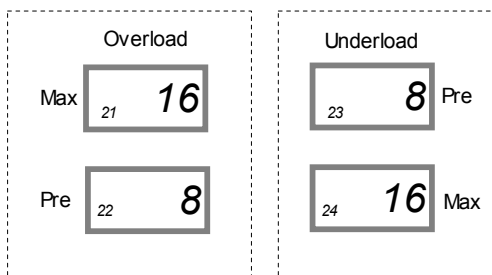
The Auto Set feature works in conjunction with the alarm set-point margins. Windows 21, 22, 23 and 24 depending on the operational setting of Window 5.

Display Window 01

01 22

Auto Set Margins

Windows 21 - 24



Hold

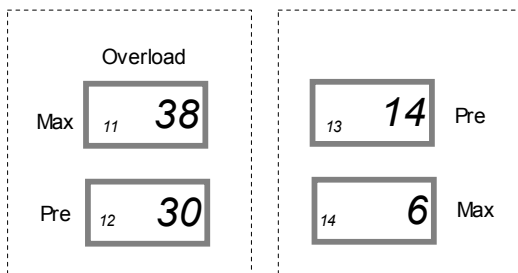


for 3 seconds until Window 01 displays SET

01 SET

Alarm Levels Set

Windows 11 - 14



Step 14.

Verify Alarm Parameters

Display Window 01

01 22

Vary the process so that the measured value Window 01 goes above/below the alarm set points

Verify the correct operation of the process when the alarms have operated

Make Adjustments to Alarm levels if required

Step 15.

Making Manual Adjustments to Alarm Levels (Windows 11 - 14)

Display Window 11

11 38

Settings 0 - 100%

Press or until desired value reached

Press to accept new value

Step 16.

Making Manual Adjustments to Alarm Margins (Windows 21 - 24)

Display Window 23

23 8

Settings 0 - 100%

Press or until desired value reached

Press to accept new value

Repeat Step 11 if changes are made to Windows 21 - 24

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Example 1: Parameters for Commissioning the M20 as an Underload Monitor

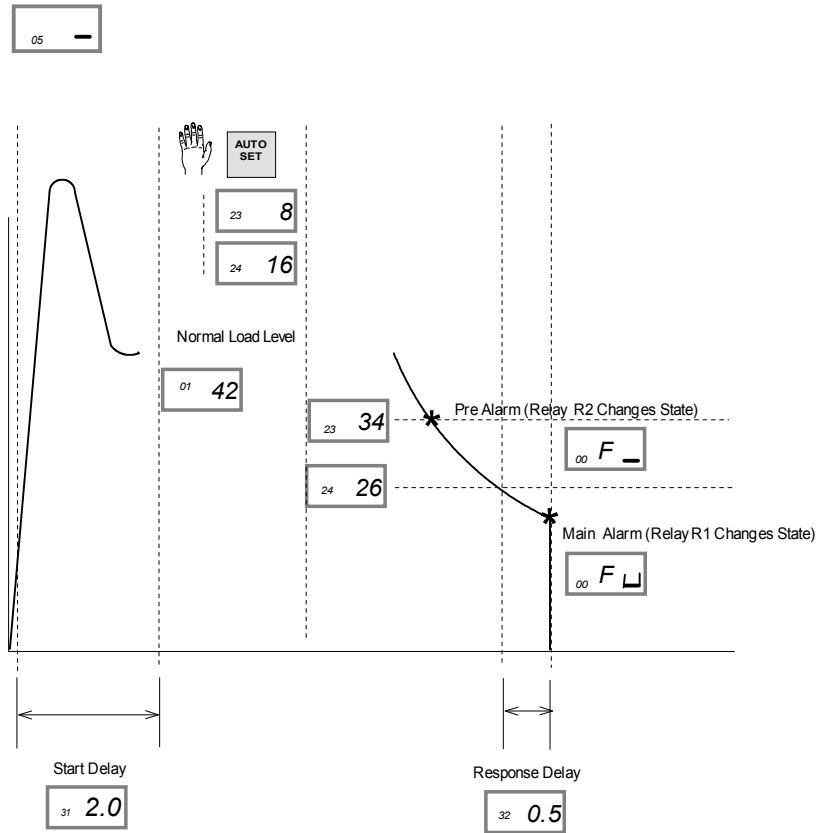


Figure 6

Example 2: Parameters for Commissioning the M20 as an Overload Monitor

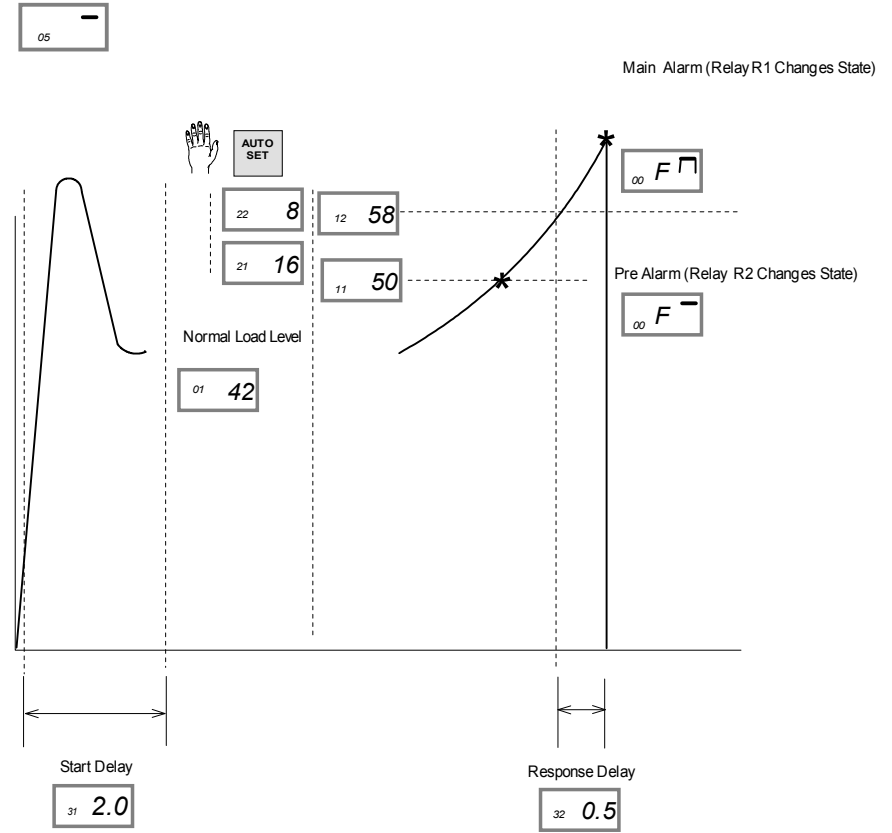



Figure 7

NOTE

For Underload and Overload Monitoring Set parameter 5 to  this will then be a combination of both Example 1 and Example 2 above.


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Advanced Features

The following Information relates to other features available within the M20.

Measured Line Voltage (Window 02)

To View the Measured Line Voltage


Press  until Window 02 is displayed

Display Window 02



Measured Current (Window 03)

To View the Measured Current

Press  until Window 03 is displayed

Display Window 03



Parameter Lock (Window 04)

To prevent accidental changes to set parameters

Only allows access to Windows 00, 01, 02, 03 and 04


Press  until Window 04 is displayed


Display Window 04



Press  or  until the display shows



Press  to accept this value

When the parameters are locked a lock  appears on the display

To unlock parameters repeat the above procedure

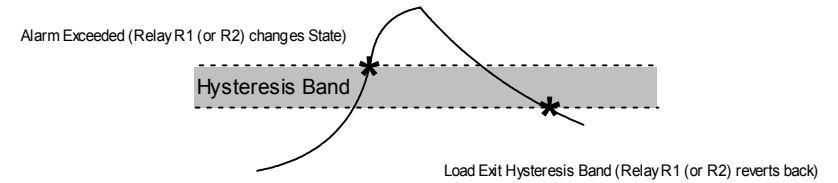
Hysteresis - Dead Band (Window 33)

Set a Dead Band for the Alarm Relay

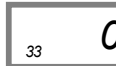
May be used if the Alarm relays are set to **unlatched**.



Prevents the output relay from chattering.


The relays will change state when the monitored load exceeds the alarm level. The relay will reset only after the load is back in the normal range by the hysteresis amount. This setting is **not** independent for each relay. Once set **both** relays will operate with a Hysteresis Band



Press  until Window 33 is displayed



Press  or  until the desired value is reached

Press  to accept this value



Alarm at No Motor Current (Window 62)


Changes the State of **Both** relays if the monitored current drops to zero

Press  until Window 62 is displayed

Display Window 62



Press  or  until the desired operation is displayed

Press  to accept this setting

Digital Input Terminal 5 (Window 81)

Set the function of terminal 5 digital input.


Note: For the correct wiring of this Input see the Control Wiring Examples


The input can be set to one of 3 functions.



rES: External Reset


AU: Remote Auto set (See Step 12 of the parameter set up for Auto set function)

blo: Temporarily disables the Pre Alarm Function

Press  until Window 81 is displayed

Display Window 81 


Press  or  until the desired operation is reached

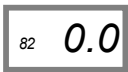
Press  to accept this value



Block Timer (Window 82)


Only visible if parameter 81 is to blo

This times the duration that the Pre Alarm is disabled after the digital input is removed.

Press  until Window 82 is displayed

Display Window 82 


Press  or  until the display shows the required value

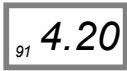
Press  to accept this value



Analog Output (Window 91)


The analog output can be used for control or display purposes. Set the desired mA output for Terminals 3 and 4 in relation to the measured motor load.

Values 0 - 20 mA (0 - 100 % Load)
4 - 20mA (0 - 100 % Load)
20 - 0 mA (0 - 100 % Load)
20 - 4 mA (0 - 100 % Load)

Press  until Window 33 is displayed


Display Window 91 

Press  or  until the desired operation is reached



Press  to accept this operation

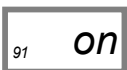
Analog Output Span Adjustment (Window 91)

The analog output can be set to span a certain range. For example 0-20mA (20 - 55% Load)

Press  until Window 91 is displayed

Display Window 91 


Press  and  together until 'on' appears in the display

Display Window 91 


Windows 92 and 93 are now accessible


Analog Output Span Adjustment (Window 92)


See Window 91 to access this window. To set the lowest load value for the analog output.

Press  until Window 92 is displayed

Display Window 92 

Press  until the display shows the required value


Display Window 92 

Press  to accept this value


Now, if parameter 91 was set to 0 - 20 mA the span would be from 20 - 100% load.


Analog Output Span Adjustment (Window 93)

See Window 91 to access this window. In conjunction with Window 92 set the highest load value for the analog output.

Press  until Window 93 is displayed

Display Window 93 

Press  until the display shows the required value

Display Window 93 

Press  to accept this value

Now, if parameter 91 was set to 0 - 20 mA the span would be from 20 - 55% load.



Factory Defaults (Window 99)


To return the M20 to its factory default settings.

Values: **Usr (User)**
dEF (Default)

Press  until Window 99 is displayed

Display Window 99 

Press  or  until the desired operation is reached

Press  to accept this operation

Shaft Power / Input Power

The M20 by default calculates Shaft Power. Shaft Power is the calculated motor power relating to the driven load.



Shaft Power = Input Power - Motor losses


It is possible to change the M20 to display Input Power.

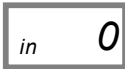
If the M20 is set to display Input Power all alarm levels become relative to the Input Power not Shaft Power

Display Window 01  Default = Shaft Power

Settings Shaft Power, Input Power

Hold  and  for 3 Seconds, display will show Pin

Display Window 01 

Display Window 01  in will now flash alternately with the window number

Note: If the M20 is set to display Input Power values set in windows 11, 12, 13 and 14 will be relative to input power not to shaft power.

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Alarm Messages (Window 00)

Main Alarm (Overload) Exceeded



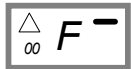
The Main Alarm level set in Window 11 has been exceeded

Relay R1 has changed state

Press  to reset the alarm once the load has dropped below the set value

NOTE If Parameter 61 is set to OFF the Alarm will automatically reset when the load drops below the set value

Pre Alarm(Overload) Exceeded



The Pre-Alarm level set in Window 12 has been exceeded

Relay R2 has changed state


The Pre-alarm automatically resets once the load has dropped below the set value

Main Alarm (Underload)



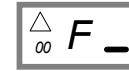
The measured load has fallen below the Main Alarm Level set in Window 14

Relay R1 has changed state

Press  to reset the alarm once the load has dropped below the set value

NOTE If Parameter 61 is set to OFF the Alarm will automatically reset when the load drops below the set value

Pre Alarm(Underload)



The load level has fallen below the Pre-Alarm Level set in Window 13

Relay R2 has changed state

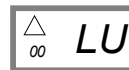
The Pre-alarm automatically resets once the load has dropped below the set value

Alarm at No Motor Current



Parameter 62 (No Motor Current) is set to 'on'

Supply Voltage



The voltage measured at terminals 9, 11 and 13 is below the range of the M20



The voltage measured at terminals 9, 11 and 13 is above the range of the M20

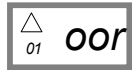
Turn off the supply to the M20 to prevent damage

Review the Voltage requirements on the M20 label


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Alarm Message (other Windows)

Out Of Range (Window 01)




The calculated shaft power has exceeded 125% of the HP value set in Window 41

Press  to reset the alarm once the load has dropped

Out Of Range (Window 03)



The measured motor current has exceeded 125% of the FLA value set in Window 42

Press  to reset the alarm once the measured amps has dropped






8

Trouble Shooting

Problem	Solution
Window 01 always shows zero load even when the motor is running	Ensure that the CT is in the L1 phase going to the motor, not in the wire that is connected to L1 feeding the M20 module. Check that the CT is in the same phase as the phase connected to Terminal 9. Check the current transformer is connected to terminals 1 and 2 and good contact is being made. Check that window 03 shows a phase current. Ensure that the value set in window 41 is the same as the rated motor power. Check that the value in window 42 is the same as the motor FLA amps.
Window 01 shows an improper power reading when the motor is running	Check that the CT is in the same phase as the phase connected to Terminal 9. Check the correct CT has been used for the size of the motor FLA. Check the number of loops through the CT is correct see tables 1,2 and 3.
Window 03 shows an improper value of the phase current	Check that the CT is in the same phase as the phase connected to Terminal 9. Check the correct CT has been used for the size of the motor FLA. Check the number of loops through the CT is correct see tables 1,2 and 3. Check that the value in window 42 is the same as the motor FLA amps.
The monitor never gives an alarm	Check that window 01 shows a value greater than zero with the motor running. Lower or Raise the alarm parameters in windows 11 and 14 to be above or below the normal running load and ensure that display 00 shows Underload or Overload, if the M20 responds correctly re-evaluate the alarm levels required.
The monitor is continually in alarm	Review the alarm parameters in windows 11 and 14 and ensure that they are not being exceeded, if they are being exceeded, re-evaluate the alarm levels required. Check to see if Window 61 (alarm latch) is to ON. If so a reset is required.
Message displayed is either LU or OU	See Alarm Messages other Windows
Window 01 Message displayed is oor	See Alarm Messages other Windows
Window 03 Message displayed is oor	See Alarm Messages other Windows

9

Parameter List

Window	Function	Range	Display Symbol	Default
00	Alarm Indication			
01	Shaft Power	0 - 125% KW 0 - 745 KW 0 - 125 % HP 0 - 999 HP	% KW %	0 - 125 % KW
02	Actual Line Voltage	90 - 760 Vac	V	
03	Measured Current	0.00 - 999A	A	
04	Parameter Lock	0 - 999		
05	Monitor Function	Overload Underload Overload & Underload	   	Overload & Underload
11	Max Main Alarm (Relay 1)	0 - 125 0 - 745 0 - 125 0 - 999	% KW %	100 2.2 100 3
12	Max Pre-Alarm (Relay 2)	0 - 125 0 - 745 0 - 125 0 - 999	% KW %	100 2.2 100 3
13	Min Pre-Alarm (relay 2)	0 - 125 0 - 745 0 - 125 0 - 999	% KW %	0 0 0 0
14	Min Main Alarm (Relay 1)	0 - 125 0 - 745 0 - 125 0 - 999	% KW %	0 0 0 0
21	Max Main Alarm margin	0 - 100	%	16
22	Max Pre-Alarm margin	0 - 100	%	8
23	Min Pre-Alarm margin	0 - 100	%	8
24	Min Main Alarm margin	0 - 100	%	16
31	Start Delay	1 - 999	S	2.0
32	Response Delay	0.1 - 90	S	0.5
33	Hysteresis	0 - 50	%	0
41	Rated Motor Power	0.10 - 745 0.13 - 999	22 30	KW
42	Rated Motor FLA	0.01 - 999	5.6	A

Window	Function	Range	Display Symbol	Default
43	Number of Phases	1PH / 3PH		3PH
61	Main Alarm Latch	on/OFF		OFF
62	Alarm At No Motor Current	on/OFF		OFF
63	Main Alarm Relay 1	nc/no		nc
64	Pre-Alarm Relay 2	nc/no		nc
81	Digital Input	rES / AU / bLo		rES
82	Block Timer	0.0 - 90	S	0.0
91	Analog Output	0.20 4.20 20.0 20.4	0.20	0.20
92*	Analog Output Low	0 - 100		
93*	Analog Output High	0 - 125		
99	Factory Defaults	dEF / USr		dEF

* Optional Parameters associated with Advanced Features

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Technical Data

Dimensions	1.77" x 3.54" x 4.53" (W x H x D)
Mounting	35 mm DIN Rail (Supplied)
Weight	10.5 oz
Supply Voltage (+/- 10%)	1 x 100 - 240 Vac 3 x 100 - 240 Vac 3 x 380 - 500 Vac 3 x 525 - 600 Vac 3 x 600 - 690 Vac
Frequency	50 - 60 Hz
Current Input	CTM Dependant (CTM 010, 025, 050, 100, 100+)
Power Consumption	max 6VA
Relay Output	5 A / 240 Vac Resistive 1.5 A / 240 Vac Pilot Duty AC12
Analog Output	max load 500 ohms
Digital Input	max 240 Vac or 48 Vdc High > 24 Vac / Vdc Low < 1 Vac/ Vdc Reset > 50 ms
Fuse	max 10A
Terminal Tightening Torque	0.56 - 0.79 NM (5 - 7 in lb)
Accuracy	+/- 2%, +/- 1 unit $\cos \phi > 0.5$; excl. Current Transformer; + 20 °C (68 °F)
Repeatability	+/- 1 unit 24h; + 20 °C (68 °F)
Temperature tolerance	max 0.1% / °C
Operating Temperature	-20 - +50 °C (-4 - +122 °F)
Storage Temperature	-30 - +80 °C (-22 - +168 °F)
Protection Class	IP 20
Approved to	CE, cUL and UL standard (up to 600 Vac)

