

# Emotron M10 Shaft Power Monitor



Instruction manual  
English



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# 1 Inside the box

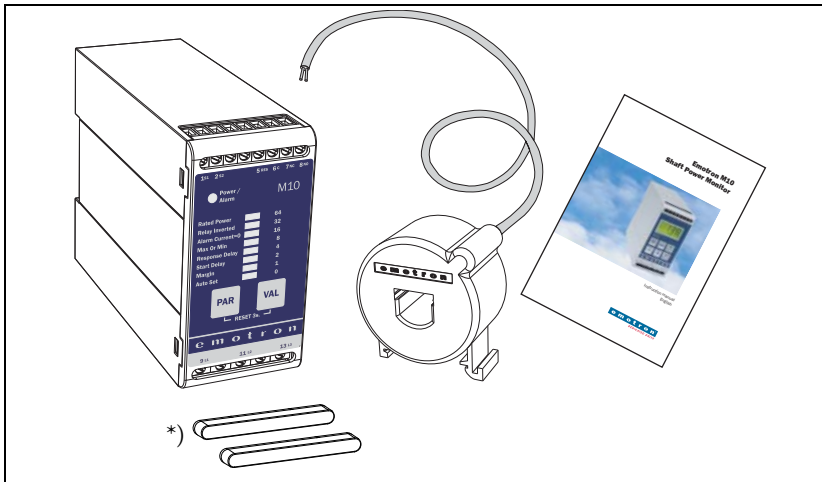
Please check the delivery. Despite the fact that all products from Emotron are carefully inspected and packed, transport damage may occur:

- Your shipment should contain the Emotron M10 shaft power monitor, a current transformer, 2x terminal covers (optional\*) and this instruction manual.
- Check carefully that the equipment ordered complies with the motor's input voltage and that the current transformer rating is as stated on the delivery note.
- Check that the contents have not been damaged during transport.
- If something is missing, or has been damaged, contact the supplier as well as the forwarding agent within 48 hours of receipt.

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**NOTE: If in doubt contact your supplier before installing or commissioning the product.**

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## 2 Safety

- Read this manual thoroughly before installing and using the Emotron M10.
- The Emotron M10 must be installed by qualified personnel.
- Always disconnect supply circuits prior to installation.
- The installation must comply with standard and local regulations.
- Pay special attention to the information in this chapter and the parts marked WARNING and CAUTION in the chapter on operation.
- Check that the Emotron M10 and the equipment are correctly connected before use.
- Should questions or uncertainties arise, please contact your local sales outlet or see Chapter 11 page 26, Service.
- Faults that arise due to faulty installation or operation are not covered by the warranty.

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**NOTE: Removing or tampering with the seal on the housing will invalidate the warranty.**

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### 3 Description

This instruction manual describes the installation and commissioning of the Emotron M10 shaft power monitor. The Emotron M10 is a single function monitor intended for machine builders and OEMs. It is the ideal choice for price sensitive applications requiring only basic under- or overload protection. For more advanced load monitoring we recommend the Emotron M20 shaft power monitor.

The Emotron M10 is well suited for supervising induction motor driven equipment, such as centrifugal pumps, magnetic pumps, mixers, scrapers, crushers and conveyors in applications with drive motors of up to 50 A. It can also be used as an electronic shear pin (Motors max. 50A).

The Emotron M10 provides reliable monitoring and protection, optimizing production equipment and minimizing expensive breakdowns and interruptions. It immediately detects any abnormal condition and initiates a warning. If the normal machine load level is exceeded, the internal relay changes state and the alarm LED turns red (LED is green at normal load). The output relay contact can be used for alarm indication and/or for machine shut-down.

Shaft power is calculated by measuring motor input power and subtracting the motor power loss calculated using a unique principle. Calculating shaft power gives more reliable supervision than non-linear techniques, such as current and phase angle measurements. Current measurement is only sufficient at high motor loads and phase angle only at low loads. Input power, sometimes called true or real power, is linear but ignores motor power loss.

Using the motor as its own sensor means no external sensors or extra cabling are required. By taking into account the motor power losses, the monitor is able to accurately measure the shaft power supplied by the motor to the application. This advanced technique allows the Emotron M10 to monitor the "application load" rather than the total motor load, which includes the varying motor losses.

The monitor is easy to install and is mounted on a standard DIN rail. It is easy to select and set up the function you wish to use, for example under- or overload protection, relay function, response delay or alarm margin. The "Auto Set" function can be used to set the desired load level automatically.

For further information, visit [www.emotron.com](http://www.emotron.com).

## 4 Getting Started

### 4.1 Please take note of the safety section

1. Pay special attention to the safety section in this manual and the parts marked CAUTION.
2. Check that the motor/supply voltage corresponds to the values on the Emotron M10 product label at the side of the monitor.
3. Make a note of the motor's rated power and rated current from its name-plate. Confirm that the current transformer supplied is of the correct size according to table 1, page 11 in this manual.

### 4.2 Connection and set-up before first start

1. Connect the Emotron M10 according to Chapter 5 and Fig. 1.
2. Make sure all safety measures have been implemented and switch on the supply voltage - Power LED turns green.
3. Minimum parameters to be set are "Rated Power" and desired relay function "Max or Min", see Chapter 8, Table 2, 3 and Fig. 6.
4. Press **PAR** once - "LED" AUTO SET turns green.
5. Keep pressing **PAR** until the desired parameter is selected e.g. RATED POWER, see Chapter 8, Table 2 and 3.
6. Press **VAL** - Factory set value or earlier set value flashes e.g. "64".
7. Keep pressing **VAL** until desired value is displayed (0 - 64).
8. Confirm chosen value by pressing **PAR**.
9. Press **PAR** again and repeat steps 4 to 8 for all parameters except for AUTO SET. See Chapter 8, Table 2, 3 and Fig. 6 for possible value settings for each of the eight parameters.
10. Start and run the motor/system at normal load conditions, also wait until the START DELAY has expired.

#### HINT!

Short-circuit the output relay during the set-up, this prevents the equipment stopping unintentionally, see Hint! in Chapter 5.

11. Press **PAR** once - "LED" AUTO SET turns green.



12. Press and hold **VAL** for 3 seconds, at normal machine load. The Auto Set load level is automatically set and the LED is switched off.
13. Set/reset e.g. start delay, response delay, margin, etc. if necessary (see Chapter 8, Table 2, 3 and Fig. 6).

If the machines "normal" load level is exceeded, the internal relay change state and the alarm LED turns red (LED is green at normal load).

# 5 Wiring

The following wiring diagram provides an example of how the Emotron M10 can be connected to control the start/stop circuit of a three-phase motor, Fig. 1, page 8. Connections to a single-phase motor are described later in this manual (Fig. 2).

1. The current transformer CTMXXX must be placed in the same phase that is connected to terminal 9, phase L1, see Fig. 1. Failure to follow this requirement will result in the monitor failing to function.
2. For single-phase connection see Fig. 2, page 9.

Normally the appropriate current transformer (CTM XXX) will have been ordered and shipped with the Emotron M10. Check that this is the case; see Chapter 6 page 11 Selection of current transformer, contact the supplier if in doubt.

When using DC voltage, terminal 6 should be connected to negative polarity (ground) and terminal 5 to positive polarity (max. 48 VDC), see Fig. 1, page 8. See also the alternative auxiliary circuit Fig. 11, page 29.

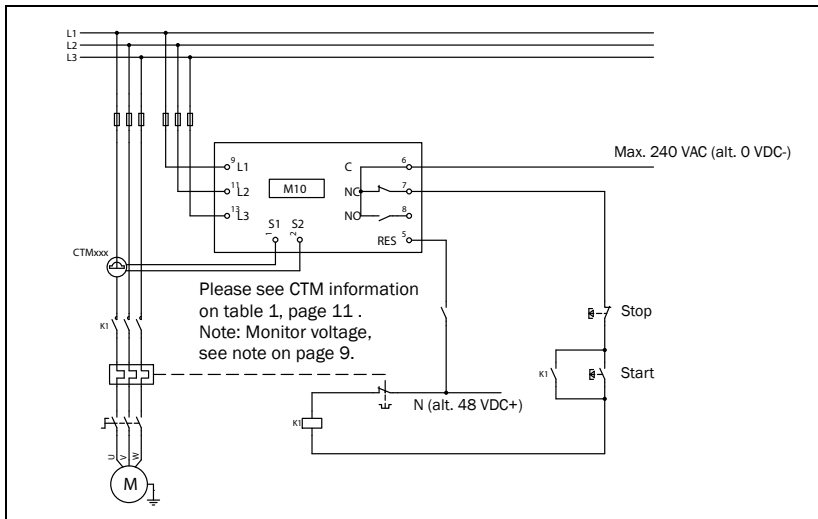


Fig. 1 Standard wiring 3-phase motors (alternatively see Fig. 11, page 29)

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**NOTE: The current transformer (CTMxxx) must be placed in the same phase that is connected to terminal 9, phase L1, see Fig. 1. Make sure that the Emotron M10 voltage range e.g. 3x100-600 VAC matches the connected motor/line voltage, e.g. 3x400V.**

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## Hint

If the START/STOP is connected as per Fig. 1, it is recommended that terminals 6 and 7 be bypassed during settings. After the settings are completed the bypass must be taken out.

Please use the enclosed plastic (rubber) insert (if ordered, optional) to cover the monitor terminals.

## Alternative example for single-phase connection

This wiring example shows the alternative connection to be made with regard to a single-phase connection. Refer to Fig. 1 for the remaining wiring.

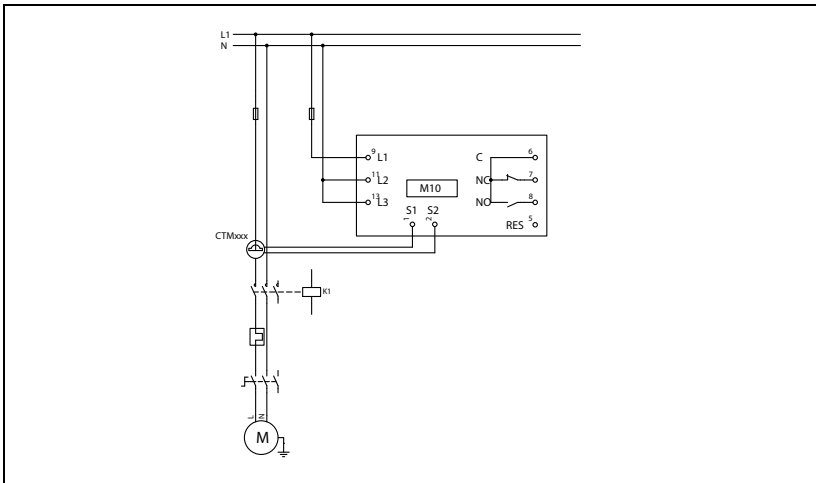


Fig. 2 Single-phase wiring example (alternatively see Fig. 10, page 28)

## 5.1 Latched or un-latched alarm

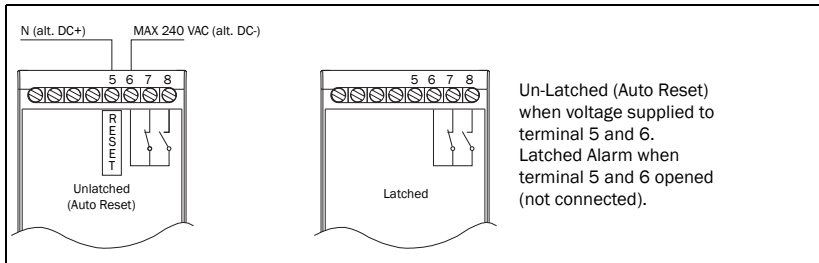


Fig. 3      *Wiring example for latched or un-latched alarm.*

When using DC voltage, alternatively see Fig. 11, page 29.

If terminal 5 is not connected, see Fig. 3, the alarm is not automatically reset when the machine load is normal again after an alarm situation. The alarm is then latched; function "Latched alarm". The alarm can then be manually reset by pressing both PAR and VAL buttons at the same time for 3 seconds. It is only possible to reset an alarm if the power level is on the "right side" of the set alarm level (depending on under- or overload monitoring).

If, however, terminal 5 is connected to an AC or DC signal the alarm will be reset automatically (un-latched alarm). This is only possible if the power level is on the "right side" of the set alarm level.

## 6 Selecting the current transformer

### 6.1 For motors up to 50 A

1. Check the rated motor current on the motor plate.
2. Compare this value with the rated motor current in Table 1.
3. From Table 1, select the current transformer and the appropriate numbers of windings.

Table 1 *Current transformer and number of primary windings.*

RATED MOTOR CURRENT (A)	Number of primary windings		
	CTM010	CTM025	CTM050
0.4 - 1.0	10		
1.01 - 2.0	5		
2.01 - 3.0	3		
3.1 - 5.0	2		
5.1 - 10.0	1		
10.1 - 12.5		2	
12.6 - 25		1	
26 - 50A			1

#### 6.1.1 Example

Rated motor current = 12 A.

- Select 10.1 - 12.5 A from the first column in table 1 and choose CTM 025 with two (2) primary windings (the motor wire is drawn through the CTM hole twice).

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**NOTE: Max. length of CTM cable is 1 m (39 inches). For motors with rated current over 50 A Emotron M20 must be used, contact your supplier.**

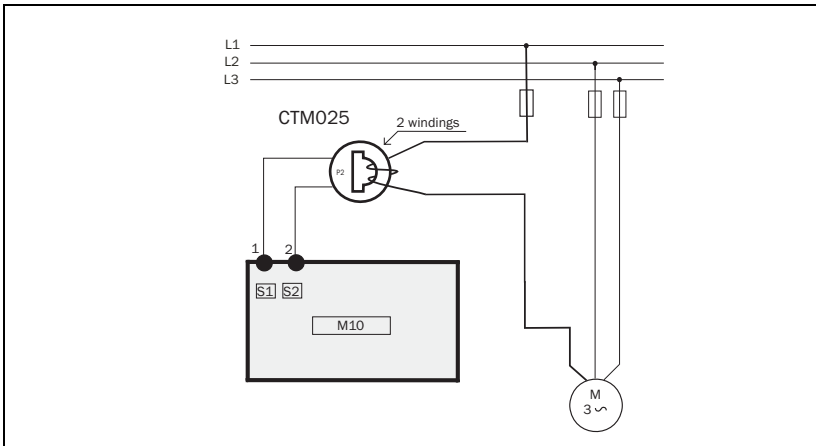
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In order to ensure an accurate calibration of the Emotron M10, it is essential that you use the correct CTM and apply the exact number of windings in accordance with the above table.

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**NOTE: Normally the appropriate Current Transformer (CTM XXX) will have been ordered and shipped with the Emotron M10. Check that this is the case; contact the supplier if in doubt.**

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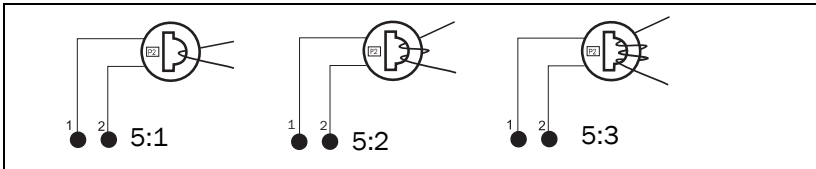


*Fig. 4 Example CTM 025 with 2 windings for a 12 A motor*

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**CAUTION: Terminals 1 and 2 (S1, S2) carry live voltage.**

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*Fig. 5 Example 1, 2 and 3 windings.*

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**NOTE: The current transformer connection and orientation are not polarity sensitive, but must be connected to the same phase that is being referenced for terminal 9 of the Emotron M10.**

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## 7 Operation

Make sure that the enclosed plastic (rubber) insert (if ordered, optional) covers the monitor terminals before you start programming.

If the normal machine load level is exceeded, the internal relay changes state and the Power/Alarm LED turns red. The LED is green at "power on" and at normal load.

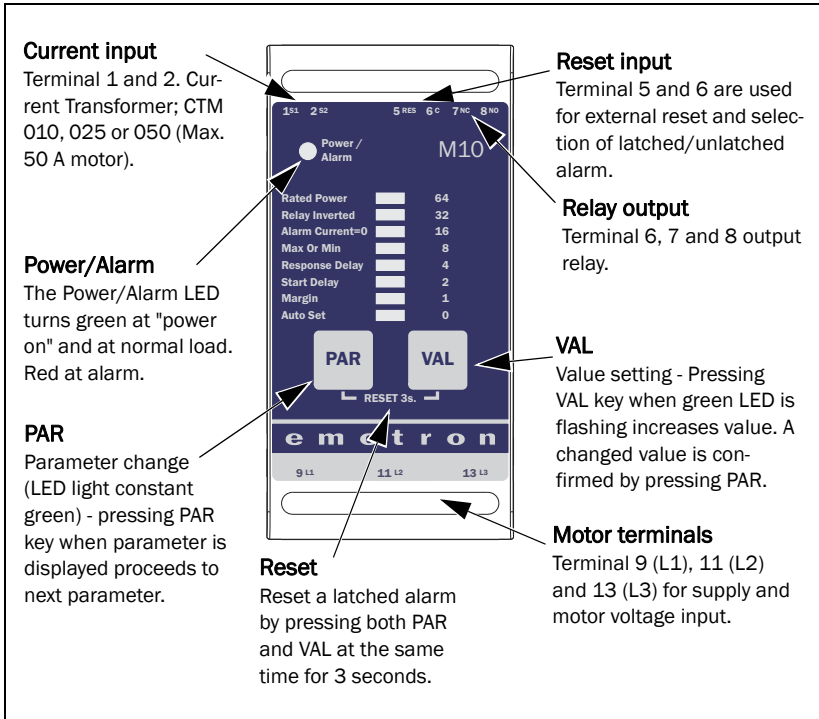
### 7.1 LED

- A constant green LED indicates a parameter type.
- A flashing green LED indicates a value.

Under normal system operation, the eight LEDs are all off (see table 2, page 18). Any illuminated LEDs will be automatically switched off 30 seconds after the last key press.

## 7.2 Auto Set

The alarm load level is automatically set by the Auto set function, see Chapter 8



The value for a parameter, e.g. seconds, kW, HP or margin, can only be set as 0, 1, 2, 4, 8, 16, 32 or 64. Select closest value.

The Emotron M10 with article number 01-3160-00 "Fast Response" (M10 FR) is identical with the standard Emotron M10 except for where the start-up delay and the response delay are shorter than below:

- Article number 01-2487-10 standard Emotron M10:  
RESPONSE DELAY: 0.05 - 64 s  
START-UP DELAY: 1 - 64 s
- Article number 01-3160-00 "Fast Response" (M10 FR):  
RESPONSE DELAY: 0.05 - 6.4 s  
START-UP DELAY: 0.1 - 6.4 s



The Emotron M10 is a single function monitor intended for machine builders and OEMs. It is the ideal choice for price sensitive applications requiring only basic under- or overload protection. If the operator needs to know the normal load level and set load level of the output shaft power either in percent or kW/HP the Emotron M20 must be used.

# 8 Programming

Set-up and program the Emotron M10 according the "Example" on page 17, see also table 2, page 18, table 3, page 19 and Fig. 7, page 19.

In Chapter 4 more information and hints are given about connection and set-up before the first start-up.

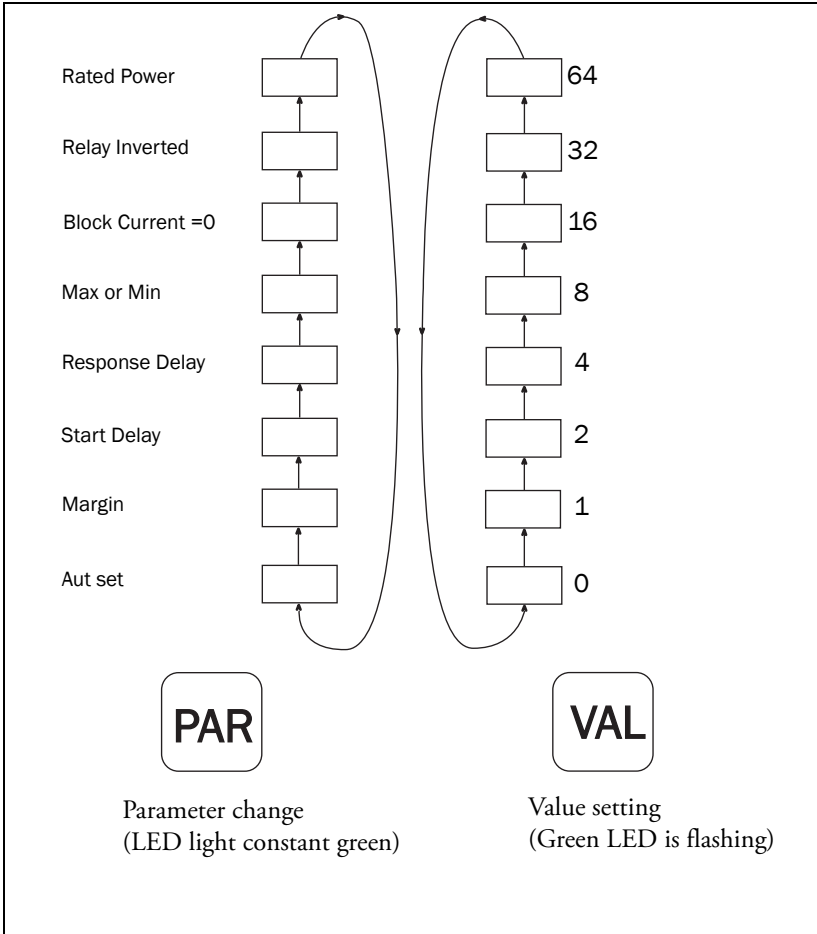


Fig. 6 Parameter change and value setting.

When the Emotron M10 is installed, the machine is running, and the normal machine load level is exceeded, the internal relay changes state and the Power/Alarm LED turns red. The LED is green at normal load.

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**CAUTION: Make sure that all safety measures have been taken before switching on the supply voltage and starting the motor/machine in order to avoid personal injury.**

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### Example: Conveyor with overload protection

Conveyor with overload protection, motor 11 kW (Fig. 7, page 19).

1. Check output power on motor plate and see table 3 (11 kW = Rated Motor Power 6.1- 12) - setting 8.
2. Switch on the supply voltage - Power LED green.
3. Press **PAR** once - “LED” AUTO SET turns green.
4. Keep pressing **PAR** until RATED POWER is selected, see Fig. 6, page 16.
5. Press **VAL** - Value “64” flashes (factory setting).
6. Set recommended value according to table 3. Keep pressing **VAL** until chosen value (8) flashes.
7. Confirm chosen value by pressing **PAR**.
8. Press **PAR** again and select MAX.
9. Press **VAL**. Choose the factory setting MAX - Overload Protection - “1”.
10. Confirm chosen value (1) by pressing **PAR**.
11. Press **PAR** again and select RELAY INVERTED.
12. Press **VAL**. Choose the factory setting “no” = “0”.
13. Confirm chosen value (0) by pressing **PAR**.

The above parameters are necessary to set for safe functioning. Note that “Rated power” for the motor must be set before Auto Set.

### Hint

Change the load on the machine to find out if appropriate load limit margin is set correctly. You can also reduce the margin by one or more steps to find out at what level the machine will trip. See Fig. 7, page 19. Set/reset e.g start delay, response delay, trip margin etc. if necessary (see table 2, page 18).

## More hints

- If the alarm level is difficult to set - simply perform an Auto Set when the motor is stopped. Then start the machine, run at normal load and perform an Auto Set again.
- If a wrong value is unintentionally set - simply set a new value. If the value is not confirmed by pressing PAR, the new value is not accepted (time out after 30 seconds).

Table 2 Parameters and values.

Parameter	Value	Factory setting	Note
RATED POWER	0 1 2 4 8 16 32 64	64	See table 3
RELAY INVERTED	0 (no) 1 (yes)	0	0 = Relay activated at alarm
ALARM CURRENT = 0	0 (no) 1 (yes)	0	Alarm at no motor current
MAX OR MIN	0 (MIN) 1 (MAX)	1	0 = under load 1 = overload alarm
RESPONSE DELAY	0 1 2 4 8 16 32 64	2	Response delay in seconds (0=50 ms)
START DELAY	0 1 2 4 8 16 32 64	2	Start delay in seconds
MARGIN (% of rated power)	0 1 2 4 8 16 32 64	8	Load change for alarm sensitivity, Fig. 7
AUTO SET	Auto Set load level is automatically set if VAL key is pressed for 3 seconds.		VAL key must be pressed when LED parameter AUTO SET is light. LED bar is switched off when Auto Set level is set.

Table 3 Setting of rated motor power.

Setting	Rated motor power in kW or HP
0	0 - 0.5
1	0.51 - 1.5
2	1.51 - 2.5
4	2.51 - 6
8	6.1 - 12
16	12.1 - 24
32	24.1 - 48
64	48.1 - 75

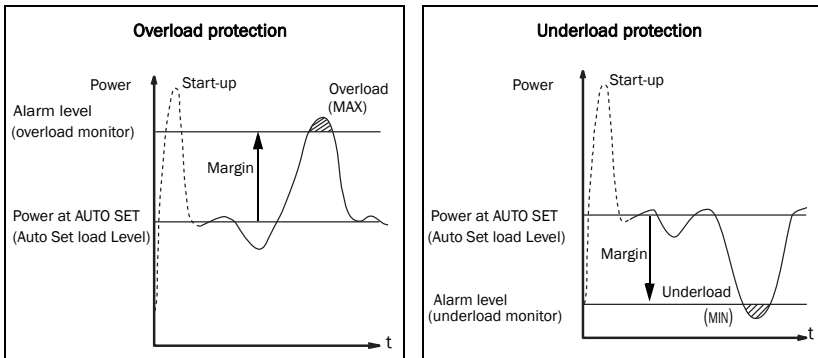


Fig. 7 Alarm level and margin.

## 9 Parameter list

Table 4 Parameter list

<b>Parameter</b>	<b>Factory setting</b>	<b>Actual setting</b>	<b>Alt. setting</b>
Rated power	64		
Relay inverted	0		
Alarm current = 0	0		
Max or Min	1		
Response delay	2		
Start delay	2		
Margin	8		

## 9.1 Terminals

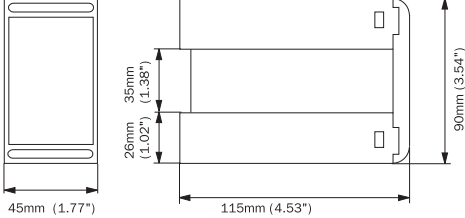
Table 5 Terminals and labels

Terminal	Label	Function
1	S1	Current transformer input for CTM 010, CTM 025 or CTM 050, blue wire <sup>1</sup>
2	S2	Current transformer input, brown wire <sup>1</sup>
3	(not used)	
4	(not used)	
5	RES	Reset input. Latched or unlatched alarm is selected via this input. Connect to + at DC.
6	C	Alarm relay common and also reset common. Connect to "-" at DC.
7	NC	Alarm relay normally closed
8	NO	Alarm relay normally open
9	L1	Motor voltage phase L1
10	(not used)	
11	L2	Motor voltage phase L2 (N for single phase motors) <sup>2</sup>
12	(not used)	
13	L3	Motor voltage phase L3 (N for single phase motors) <sup>2</sup>

<sup>1)</sup> Note! Terminals 1 and 2 (S1, S2) carry line voltage.

<sup>2)</sup> N must be connected to terminal 11 and 13 (single phase).

## 10 Technical data

<p>Dimensions (WxHxD)</p>	<p>45x90x115 mm (1.77" x 3.54" x 4.53")</p> 
<p>Mounting</p>	<p>35 mm DIN-rail 46277</p>
<p>Weight</p>	<p>175 g (5.65 oz)</p>
<p>Supply voltage (VAC)*</p>	<p>1x100-240 (± 10 %)  3x100-600 (± 10 %)  3x600-690 (± 10 %)</p>
<p>Frequency</p>	<p>50 or 60 Hz</p>
<p>Current input</p>	<p>Current transformers; CTM 010, 025 or 050  (Max 50 A motor)</p>
<p>Power consumption</p>	<p>Max 3 W</p>
<p>Start-up delay</p>	<p>1-64 s ("Fast response, see page 14; 0.1 - 6.4s)</p>
<p>Response delay</p>	<p>0.05-64 s ("Fast response, see page 14; 0.05 - 6.4s)</p>
<p>Relay output</p>	<p>5 A/240 VAC Resistive, 1.5 A/240 VAC Pilot duty/  AC12</p>
<p>Fuse</p>	<p>Max 10 A</p>
<p>Terminal wire size</p>	<p>Use 75 °C copper (CU) wire only.  0.2-4.0 mm<sup>2</sup> single core (AWG12).  0.2-2.5 mm<sup>2</sup> flexible core (AWG14),  stripp length 8 mm (0.32")</p>
<p>Terminal tightening torque</p>	<p>0.56-0.79 Nm (5-7 lb-in)</p>
<p>Repeatability</p>	<p>± 2.5% FS, 24 H, @ +25 °C (+77 °F)</p>
<p>Temperature tolerance</p>	<p>&lt;0.1%/°C</p>



External RESET on term. 5	Max 240 VAC or 48 VDC. High:≥24 VAC/DC Low:< 1 VAC/DC. Reset >50 ms
Operating temperature	-20 (4 °F) – +50 °C (+122 °F)
Storage temperate	-30 (22 °F) – +80 °C (+176 °F)
Protection class	IP20
RoHS directive	2002/95/EC
Approved to	CE (up to 690VAC), UL and cUL (up to 600 VAC)

\*)Please note that these are separate voltage units; see table 6 with ordernumbers

*Table 6 Order numbers and designation*

Order number	Designation
01-2487-10	Emotorn M10 1x100-240/3x100-690 VAC
01-3160-00	Emotorn M10 1x100-240/3x100-690 VAC "Fast response"

### 10.0.1 Technical Data for Current Transformer (CT)

Type	Dimensions (WxØ)	Weight*	Mounting
CTM 010	27(35) X Ø48mm	0.20 kg	35mm DIN rail 46277
CTM 025	27(35) X Ø48mm	0.20 kg	35mm DIN rail 46277
CTM 050	27(35) X Ø48mm	0.20 kg	35mm DIN rail 46277

\*) Weight including 1 m (39 inch) cable. Please note that max. length of the CT cable is 1 m and this cable can not be extended.

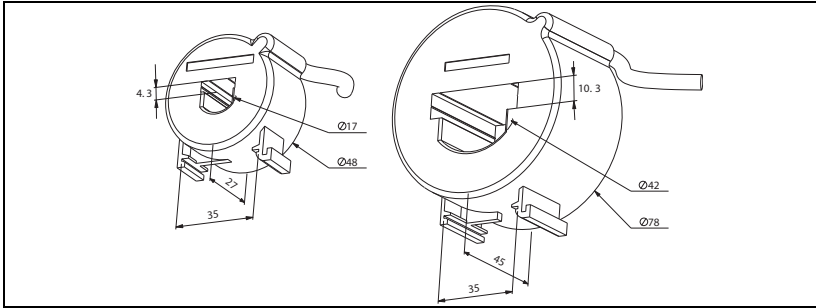


Fig. 8 Current Transformer CTxxx.

## 10.0.2 Accessories and documentation

Order number	Designation
01-2471-10	Current Transformer (CT) CTM010, max. 10A
01-2471-20	Current Transformer (CT) CTM025, max. 25A
01-2471-30	Current Transformer (CT) CTM050, max. 50A
01-2368-00	Front Panel Kit 1 (2x terminal covers included)
01-4136-01	2x terminal covers
01-2550-00	Instruction manual (Swedish)
01-2550-01	Instruction manual (English)

## 10.1 Dismantling and disposal

The product is designed to comply with the RoHS directive, and shall be handled and recycled in accordance with local legislations.

## EU (European Union) specifications

EMC	EN 61000-6-3, EN 61000-6-2 EN 61000-4-5
Electrical safety	EN 60947-5-1
Rated insulated voltage	690 V
Rated impulse withstand voltage	4000 V
Pollution degree	2
Terminals 3, 4, 5, 6, 7 and 8 are basic insulated from the line.	
Terminals 3 and 4 are basic insulated from terminals 5, 6, 7 and 8.	

## 10.2 US specifications

### FCC (Federal Communications Commission)

This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference, in which case, the user will be required to correct the interference at their own expense.

## 10.3 Canada specifications

### DOC (Department of communications)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the Canadian Interference-Causing Equipment Regulations. Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

# 11 Service

This manual is valid for the following model:

Emotron M10.

Document number:	01-2550-01
Document version:	r3
Date of release:	2009-09-15

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**[www.emotron.com](http://www.emotron.com)**

Protected by utility patents EP 1027759 and US 6879260

# 12 Appendix

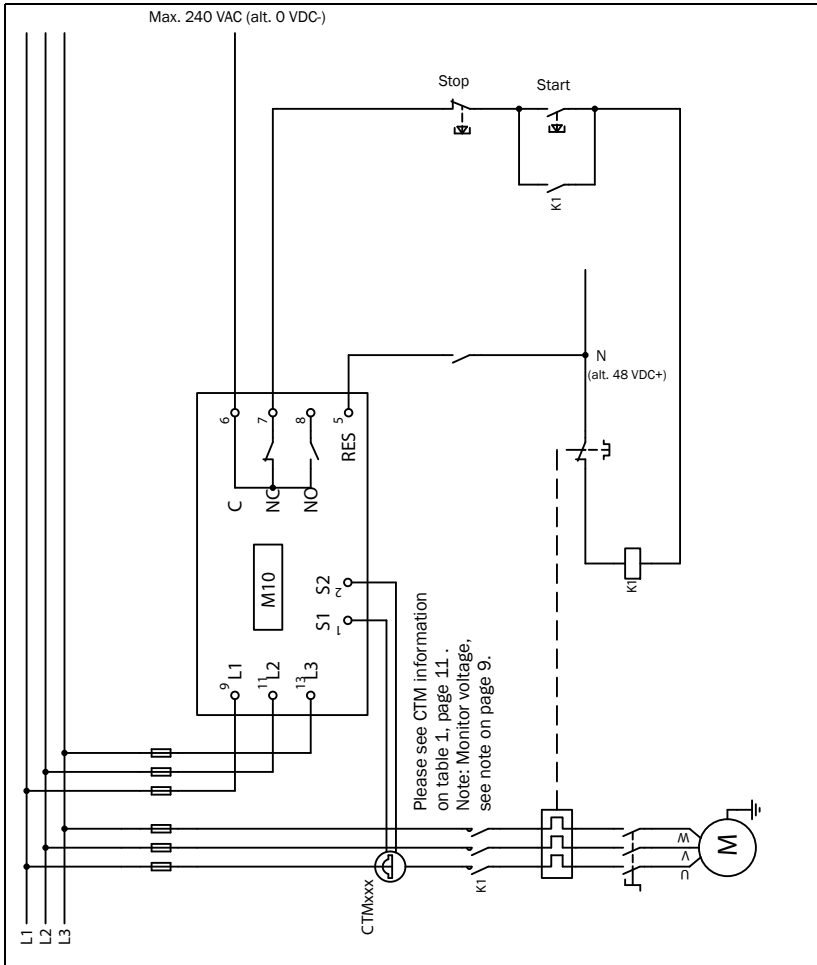


Fig. 9 M10 connection example

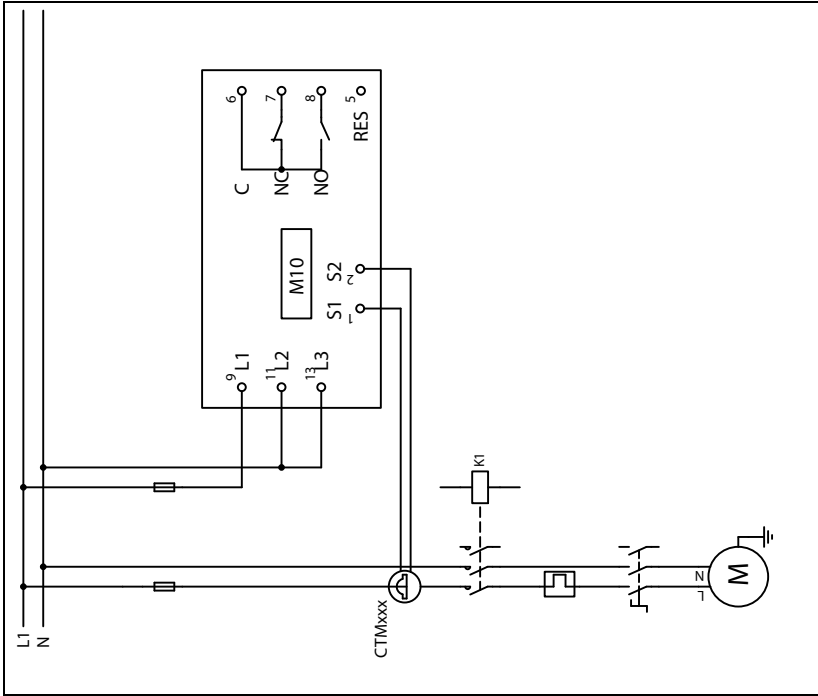


Fig. 10 M10 single-phase connection example

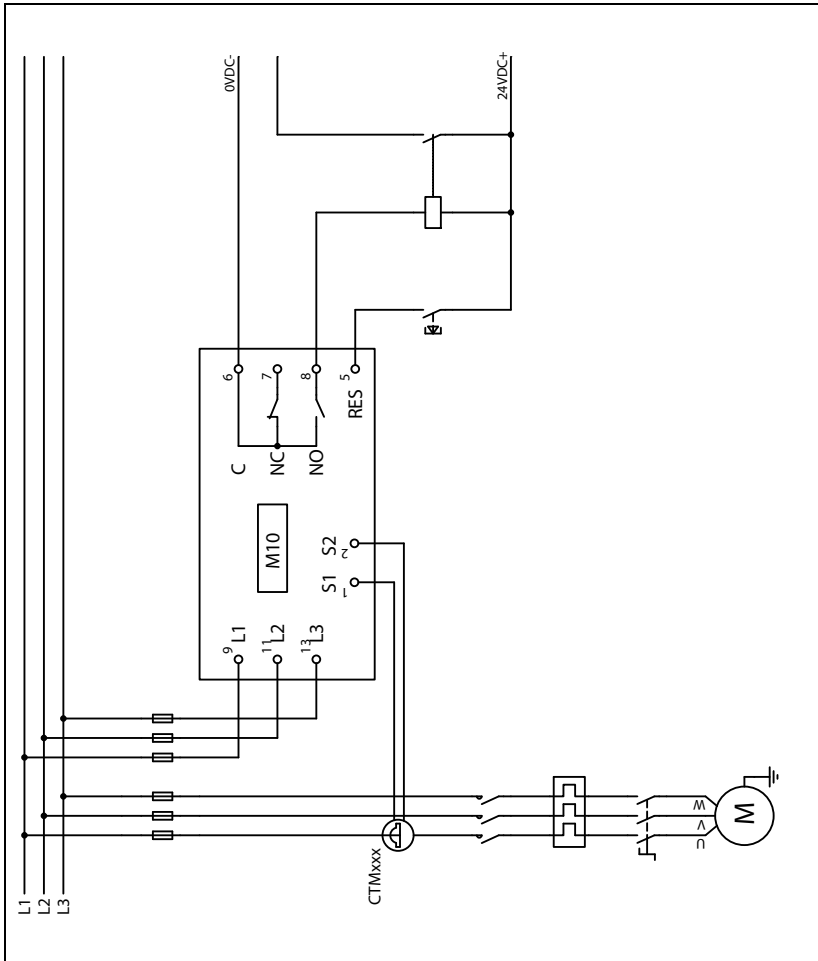


Fig. 11 M10 example of auxiliary circuit when VDC is used.









***DEDICATED DRIVE***

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