



TECHNICAL SERVICE MANUAL

POWER LOAD MONITOR MOTOR SHAFT OUTPUT POWER MEASUREMENT

SECTION	TSM 750
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Power Load Monitor

INTRODUCTION

This instruction manual describes the installation and operation of the Power Load Monitor. Its function is to supervise induction motor driven equipment and provide alarms or motor shutdown when abnormal conditions are detected. If the machine's "normal" load level is exceeded, the internal relay change state and the alarm LED turns red. The output relay contact can be used for alarm indication and/or machine shutdown. The unit is intended for price sensitive applications that only demand non-complex protection against under or overload for motors up to 50A.

VIKING PART NUMBER	RATED MOTOR CURRENT (A)
2-E90-012-999-00	0.4 – 10.0
2-E90-013-999-00	10.1 – 25.0
2-E90-014-999-00	26 – 50

Your shipment should contain the following items:

- Power Load Monitor
- Current transformer
- Instruction manual

Check carefully that the Power Load Monitor complies with the motor's input voltage and that the current transformer rating is as stated on the delivery packaging and that the contents have not been damaged in shipping.



Shipment Contents

SAFETY INFORMATION AND INSTRUCTIONS

IMPROPER INSTALLATION, OPERATION OR MAINTENANCE OF PUMP MAY CAUSE SERIOUS INJURY OR DEATH AND/OR RESULT IN DAMAGE TO PUMP AND/OR OTHER EQUIPMENT. VIKING'S WARRANTY DOES NOT COVER FAILURE DUE TO IMPROPER INSTALLATION, OPERATION OR MAINTENANCE.

THIS INFORMATION MUST BE FULLY READ BEFORE BEGINNING INSTALLATION, OPERATION OR MAINTENANCE OF PUMP AND MUST BE KEPT WITH PUMP. PUMP MUST BE INSTALLED, OPERATED AND MAINTAINED ONLY BY SUITABLY TRAINED AND QUALIFIED PERSONS.

THE FOLLOWING SAFETY INSTRUCTIONS MUST BE FOLLOWED AND ADHERED TO AT ALL TIMES.

Symbol
Legend :



Danger - Failure to follow the indicated instruction may result in serious injury or death.

WARNING

Warning - In addition to possible serious injury or death, failure to follow the indicated instruction may cause damage to pump and/or other equipment.



BEFORE opening any liquid chamber (pumping chamber, reservoir, relief valve adjusting cap fitting, etc.) be sure that :

- Any pressure in the chamber has been completely vented through the suction or discharge lines or other appropriate openings or connections.
- The pump drive system means (motor, turbine, engine, etc.) has been "locked out" or otherwise been made non-operational so that it cannot be started while work is being done on the pump.
- You know what material the pump has been handling, have obtained a material safety data sheet (MSDS) for the material, and understand and follow all precautions appropriate for the safe handling of the material.

WARNING

INSTALL pressure gauges/sensors next to the pump suction and discharge connections to monitor pressures.



WARNING

USE extreme caution when lifting the pump. Suitable lifting devices should be used when appropriate. Lifting eyes installed on the pump must be used **only** to lift the pump, **not** the pump with drive and/or base plate. If the pump is mounted on a base plate, the base plate must be used for all lifting purposes. If slings are used for lifting, they must be safely and securely attached. For weight of the pump alone (which does not include the drive and/or base plate) refer to the Viking Pump product catalog.



BEFORE operating the pump, be sure all drive guards are in place.



DO NOT attempt to dismantle a pressure relief valve that has not had the spring pressure relieved or is mounted on a pump that is operating.



DO NOT operate pump if the suction or discharge piping is not connected.



AVOID contact with hot areas of the pump and/or drive. Certain operating conditions, temperature control devices (jackets, heat-tracing, etc.), improper installation, improper operation, and improper maintenance can all cause high temperatures on the pump and/or drive.



DO NOT place fingers into the pumping chamber or its connection ports or into any part of the drive train if there is **any possibility** of the pump shafts being rotated.



WARNING

DO NOT exceed the pumps rated pressure, speed, and temperature, or change the system/duty parameters from those the pump was originally supplied, without confirming its suitability for the new service.



WARNING

THE PUMP must be provided with pressure protection. This may be provided through a relief valve mounted directly on the pump, an in-line pressure relief valve, a torque limiting device, or a rupture disk. If pump rotation may be reversed during operation, pressure protection must be provided on **both** sides of pump. Relief valve adjusting screw caps must always point towards suction side of the pump. If pump rotation is reversed, position of the relief valve must be changed. Pressure relief valves cannot be used to control pump flow or regulate discharge pressure. For additional information, refer to Viking Pump's Technical Service Manual TSM 000 and Engineering Service Bulletin ESB-31.



WARNING

BEFORE operating the pump, be sure that:

- It is clean and free from debris
- all valves in the suction and discharge pipelines are fully opened.
- All piping connected to the pump is fully supported and correctly aligned with the pump.
- Pump rotation is correct for the desired direction of flow.



WARNING

THE PUMP must be installed in a manner that allows safe access for routine maintenance and for inspection during operation to check for leakage and monitor pump operation.

WIRING

This wiring example shows how the Power Load Monitor can be used to control the starting and stopping circuit of the motor. Other wiring configurations are possible.

The current transformer must be placed in the same phase that is connected to terminal 9, phase L1. For single phase connection refer to Figure 2 for the alternate single phase connection. To complete the remaining wiring refer to Figure 1.

DANGER !

The monitor must be installed by qualified personal.

- Always disconnect, lockout, and tag out supply circuits prior to installing.
- The installation must comply with standard and local regulations.
- Study this manual thoroughly before installing and using the Power Load Monitor.
- Pay special attention to this section and the parts marked "CAUTION!" or "DANGER".
- Should questions or uncertainties arise, please contact your authorized Viking distributor.

Note!

Removing or breaking the seal on the housing will invalidate the warranty.

CAUTION !

If the START/ STOP is connected according to figure 1, it is recommended that terminals 6 and 7 be by-passed during settings. After the settings are completed the by-pass must be taken out.

LATCHED OR UN - LATCHED ALARM

Un-Latched (Auto Reset) when voltage supplied to terminal 5 and 6. Latched Alarm when terminal 5 and 6 opened (not connected).

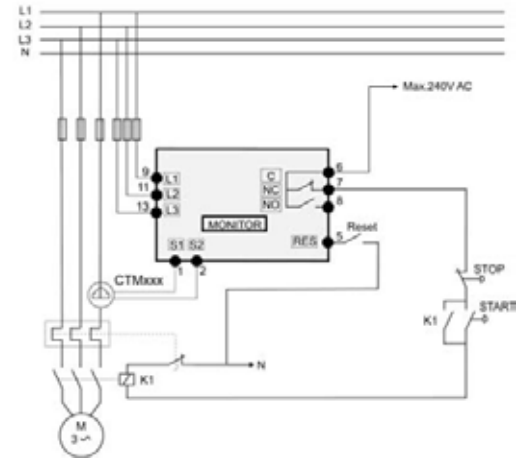


FIGURE 1
Standard Wiring Three-Phase Motors

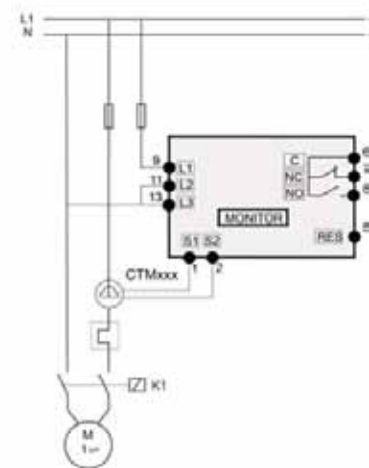


FIGURE 2
Single-Phase Wiring Example

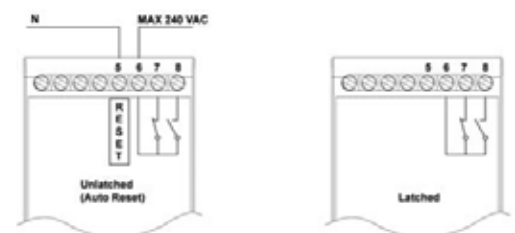


FIGURE 3.
Wiring Example For Latched Or Un-Latched Alarm

CURRENT TRANSFORMER SELECTION
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 appropriate numbers of windings for the current transformer.

CURRENT TRANSFORMERS			
VIKING PART NUMBER	2-E90-012-999-00	2-E90-013-999-00	2-E90-014-999-00
TRANSFORMER MODEL	CTM010	CTM025	CTM050
RATED MOTOR CURRENT (A)			
0.40-1.00	10		
1.01– 2.00	5		
2.01–3.00	3		
3.1-5.0	2		
5.1-10.0	1		
10.1-12.5		2	
12.6-25.0		1	
26-50			1

TABLE 1
Current Transformer And Number Of Primary Windings

DANGER !

Terminals 1 and 2 (s1, s2) carry line voltage.

EXAMPLE

- Rated motor current = 12 A.
- Select 10. 1 - 12. 5 from the first column in table 1 and choose 2-E90-013-999-00 with two (2) primary windings.

Note!
Maximum length of CTM cable is 39 inches (1 m).

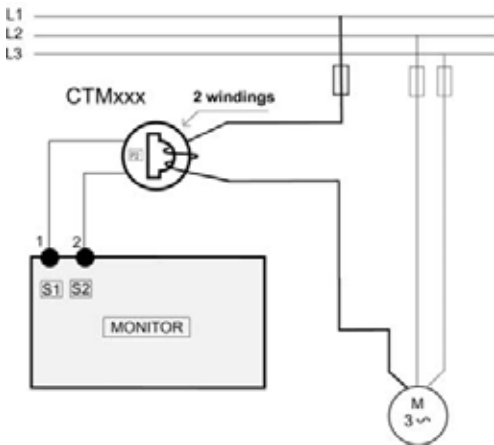


FIGURE 4
Example: CTM 025 With 2 Windings For 12 A Motor

Note!
Normally the appropriate current transformer will have been ordered and shipped with the Power Load Monitor, check that this is the case; contact the supplier if in doubt.

Note!
The transformer connection and orientation are not polarity sensitive.

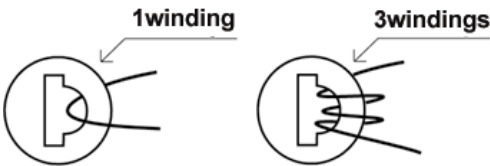


FIGURE 5
Example 1 And 3 Windings.

OPERATION

LED

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

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

AUTO SET

The alarm load level is automatically set by the Auto Set function (see Programming). 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.

PROGRAMMING

Set up the monitor as below:

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.

Verify that suction and discharge lines are connected and tight, valves are open and liquid is flowing under normal conditions to the pump before beginning to set the Power Load Monitor for normal operating conditions.

SET- UP AND FIRST START

1. Switch on the supply voltage - Power LED turns green.
2. Press **PAR** once - "LED" AUTO SET turns green.
3. Keep pressing **PAR** until the desired parameter is selected e. g. RATED POWER, see table 2 and 3.
4. Press **VAL** - Factory set value or earlier set value flashes e. g. "64".
5. Keep pressing **VAL** until desired value is displayed (0 - 64).
6. Confirm chosen value by pressing **PAR**.
7. Press **PAR** again and repeat steps 3 to 6 for all parameters except for AUTO SET. See tables 2, 3 and fig. 6 for possible value setting for each of the eight parameters.
8. Start and run 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 from stopping unintentionally, see Caution! in section "Wiring".

9. Press **PAR** once - "LED" AUTO SET turns green.
10. 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.
11. Set/re-set e.g. start delay, response delay, margin etc. if necessary (see table 2, 3, and figure 6).

Current Input

Terminal 1 and 2. Current Transformer; CTM 010, 025, or 050 (Max 50 A motor).

Reset Input

Terminal 5 and 6 are used for external reset and selection of latched/unlatched alarm.

Relay Output

Terminal 6, 7 and 8 output relay.

Power/ Alarm

The Power/ Alarm LED indicates green at "power on" and at normal load. Red at alarm.

PAR

Parameter change (LED light constant green) -pressing PAR key when parameter is displayed

VAL

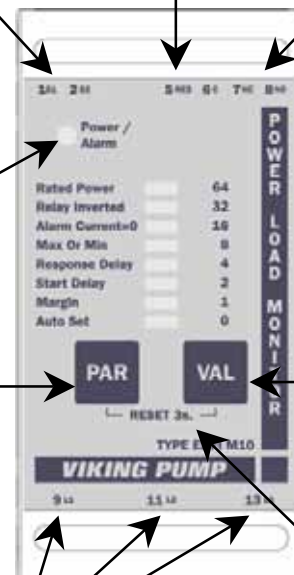
Value setting - Pressing VAL key when green LED is flashing increases value. A changed value is confirmed by pressing PAR.

Motor Terminals

Terminal 9 (L1), 11 (L2), and 13 (L3) for supply and motor voltage input.

Reset

Reset a latched alarm by pressing both PAR and VAL at the same time for 3 seconds.



EXAMPLE: PUMP WITH OVERLOAD PROTECTION

Pump with overload protection, motor 11 kW (fig. 6).

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.
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**.

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 alarm
ALARM CURRENT= 0	0(no) 1(yes)	0	Alarm at no motor current
MAX OR MIN	0(MIN) 1(MAX)	1	0=underload 1=overload
RESPONSE DELAY	0 1 2 4 8 16 32 64	2	Response delay in seconds (0=50ms)
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 6
AUTO SET	Autoset load level is automatically set if VAL key is pressed for 3 seconds		VAL key must be pressed when LED parameter AUTOSSET is lit. LED bar is switched off when Autoset level is set.

TABLE 2
Parameters and Values

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

SETTING	RATED MOTOR POWER IN HP OR Kw
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

TABLE 3
Setting or Rated Motor Power

CAUTION!

Positive displacement pumps require some form of over-pressure protection to be placed in the discharge line in conjunction with the Power Load Monitor. Pressure spikes created by sudden discharge line blockage may cause serious pump damage.

Hints!

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 figure 6. Set/Reset e.g. start delay, response delay, trip margin etc. if necessary (see *table 2*).

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).

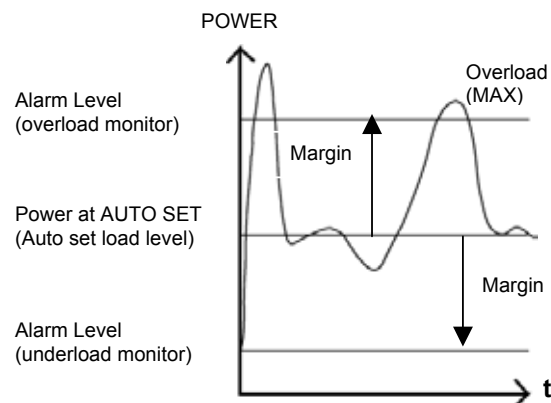
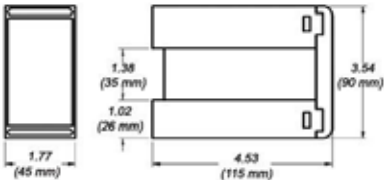


FIGURE 6
Alarm Level and Margin

TECHNICAL DATA

Dimensions (WxHxD)	1.77" x 3.54" x 4.53" (45x90x115mm) 
Mounting	35mm DIN-rail 46277
Weight	5.65 oz. (175g)
Supply Voltage	1x100-240 (±10%) 3x100-600 (±10%) 3x600-690 (±10%)
Frequency	50 or 60 Hz
Current Input	Current Transformer CTM 010,025, or 050 (max 50 A motor)
Power Consumption	Max 3 W
Start-up Delay	1-64 seconds
Response Delay	0.05-64 seconds
Relay Output	5 A/240 VAC Resistive, 1.5 A/240 VAC Pilot Duty/AC12
Fuse	Max 10 A
Terminal Wire Size	Use 75° C copper (CU) wire only. 0.2-4.0 mm ² single core (AWG12) 0.2-2.5 mm ² flexible core (AWG14) Strip length 0.32" (8mm)
Terminal Tightening Torque	5-7 lb-in (0.56-0.79 Nm)
Repeatability	± 2.5% FS, 24H @ 77°F (25°C)
Temperature Tolerance	<0.1%/ °C
External RESET on Terminal 5	Max 240VAC or 48 VDC High :> 24VAC/DC Low: < 1VAC/DC
Operating Temperature	4-122°F (-20-+50°C)
Storage Temperature	22-176°F (-30-+80°C)
Protection Class	IP20
Approved To	CE, cUL (UL up to 600V)

TERMINALS

TERMINAL	LABEL	FUNCTION
1	S1	Current transformer input for CTM 010, CTM 025, CTM 050 ¹
2	S2	Current transformer input ¹
3		
4		
5	RES	Reset input. Latched or unlatched alarm is selected via this input.
6	C	Alarm relay common and also reset common
7	NC	Alarm relay is normally closed.
8	NO	Alarm relay is normally open.
9	L1	Motor voltage phase L1
10		
11	L2	Motor voltage phase L2 (N for single phase motors) ²
12		
13	L3	Motor voltage phase L3 (N for single phase motors) ²

¹ Note Terminals 1 and 2 (S1, S2) carry Line voltage

² N Must be connected to terminal 11 and 13 (single phase)

PARAMETER LIST

PARAMETER	FACTORY SETTING	ACTUAL SETTING	ALTERNATE SETTING
Rated Power	64		
Relay Inverted	0		
Alarm Current = 0	0		
Max or Min	1		
Response Delay	2		
Start Delay	2		
Margin	8		



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DISMANTLING AND DISPOSAL

The housing is made of recyclable plastic, PC/ ABS and the circuit board contains small amounts of tin and lead. When disposing, the parts must be handled and recycled in accordance with local regulations.

EU (EUROPEAN UNION) SPECIFICATIONS

**EMC EN 50081- 1, EN 50081- 2,
EN 50082- 1, EN 61000- 6- 2**

Electrical safety IEC 947- 5- 1

Rated insulated voltage 690 V

Rated impulse withstand voltage 4000V

Pollution degree 2

Terminals 5, 6, 7 and 8 are basic insulated from the line.

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 the 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.



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 radio- électriques dépassant les limites applicables aux appareils numériques de la Classe A prescrite dans le Règlement sur le brouillage radioélectrique édicté du Canada.



WARRANTY

Viking warrants all products manufactured by it to be free from defects in workmanship or material for a period of one (1) year from date of startup, provided that in no event shall this warranty extend more than eighteen (18) months from the date of shipment from Viking. The warranty period for Universal Seal series pumps ONLY (Universal Seal models listed below) is three (3) years from date of startup, provided that in no event shall this warranty extend more than forty-two (42) months from the date of shipment from Viking.

UNDER NO CIRCUMSTANCES SHALL VIKING BE LIABLE UNDER THIS WARRANTY OR OTHERWISE FOR SPECIAL, INCIDENTAL, INDIRECT, CONSEQUENTIAL OR PUNITIVE DAMAGES OF ANY KIND, INCLUDING, BUT NOT LIMITED TO, LOST OR UNREALIZED SALES, REVENUES, PROFITS, INCOME, COST SAVINGS OR BUSINESS, LOST OR UNREALIZED CONTRACTS, LOSS OF GOODWILL, DAMAGE TO REPUTATION, LOSS OF PROPERTY, LOSS OF INFORMATION OR DATA, LOSS OF PRODUCTION, DOWNTIME, OR INCREASED COSTS, IN CONNECTION WITH ANY PRODUCT, EVEN IF VIKING HAS BEEN ADVISED OR PLACED ON NOTICE OF THE POSSIBILITY OF SUCH DAMAGES AND NOTWITHSTANDING THE FAILURE OF ANY ESSENTIAL PURPOSE OF ANY PRODUCT.

THIS WARRANTY IS AND SHALL BE VIKING'S SOLE AND EXCLUSIVE WARRANTY AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ALL WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT ALL OF WHICH OTHER WARRANTIES ARE EXPRESSLY EXCLUDED.

See complete warranty at www.vikingpump.com.

