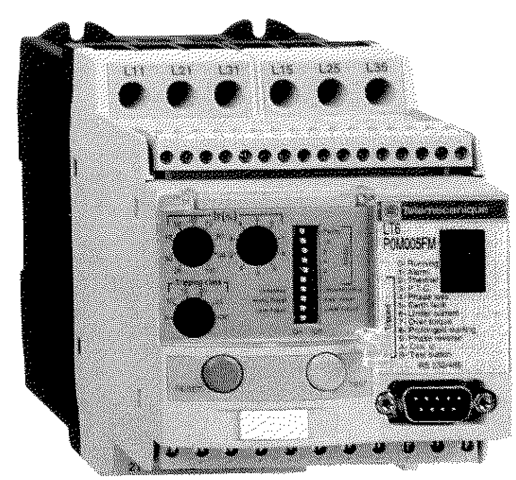
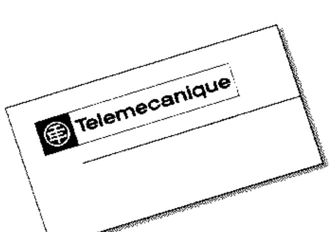
LT6-P
Telemecanique

User's Manual
USA Edition
9110IM9701

Multi-function Protection Relays





GROUPE SCHNEIDER

■ Merlin Gerin ■ Square D ■ Telemecanique

1. Contents

1. Contents

2. Glossary / definitions

PTC	Positive Temperature Coefficient. A thermistor resistor with a resistance value which increases with temperature and which increases very rapidly as the nominal operating temperature is reached.
RDF	Residual Differential Fault (earth leakage or ground fault)
rms	Root mean square value of a signal
I	Line current
I_r	Motor full load current
I_d	Phase imbalance current (calculated value)
IΔ (Delta)	Residual differential fault current (earth leakage current)
IΔr (Delta)	Set value of the residual differential fault current (earth leakage current)
Iv	Monitoring value of the underload current, a multiple of I_r
Imax	The highest value of the three phase currents
Imin	The lowest value of the three phase currents
Iav	Average value of the three phase currents
Isd	Monitoring threshold of the starting current, a multiple of I_r
I_{LC}	Torque limitation (locked rotor) current
I_{CC}	Short-circuit current
Discrete	On/Off
Θn (Theta)	Nominal temperature of the iron circuit reached with $I = I_r$ after an infinite time
Θr (Theta)	Set temperature for the thermal overload alarm
Cos φ (Phi)	Power factor
Earth fault	Ground fault
Earth fault toroid	Ground fault sensor (zero sequence current transformer)
Un	Nominal voltage

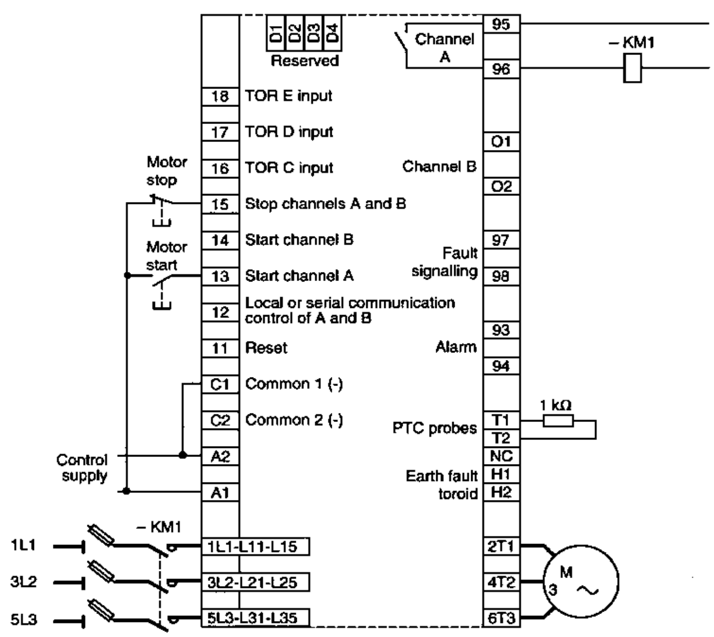
3. LT6 application circuit diagrams

The LT6 is designed to control, monitor, and protect AC motors. When operated locally by conventional operator input devices, such as pushbuttons and selector switches, the LT6 provides more protection features than the typical bimetallic or melting alloy overload relay. When used with a PLC or personal computer (PC) through a serial communication link, the LT6 becomes an "intelligent motor controller" that provides the monitoring and protection features of several relays in one compact unit.

The LT6 can be used as:

- A standard overload protection relay in a typical motor control circuit.
- A remote protection and measurement relay in an automation circuit to enable a PLC to read the measurements stored in the LT6 EEPROM.
- A motor controller (with or without additional operator input devices) to stop and start an AC motor by energizing and de-energizing power contactors.

Use of the LT6 as a protection relay

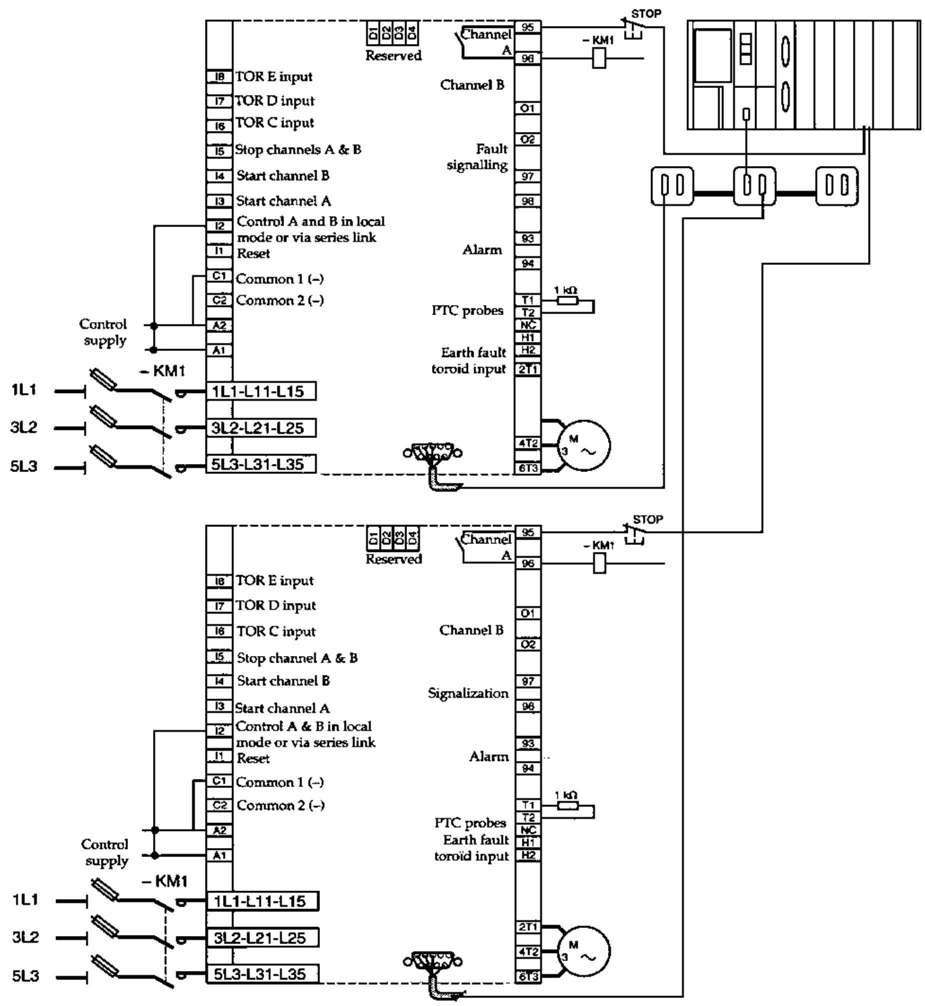


In the event of a fault, the internal contact (95-96) opens and de-energizes the power contactor (-KM1). In all applications, a description of the fault is shown by the 7-segment display on the front face of the LT6.

When used with a PC, the LA9P620 software allows the user to enable and disable additional protection features and modify the factory settings.

3. LT6 application circuit diagrams

Use of the LT6 as a remote protection and measurement relay

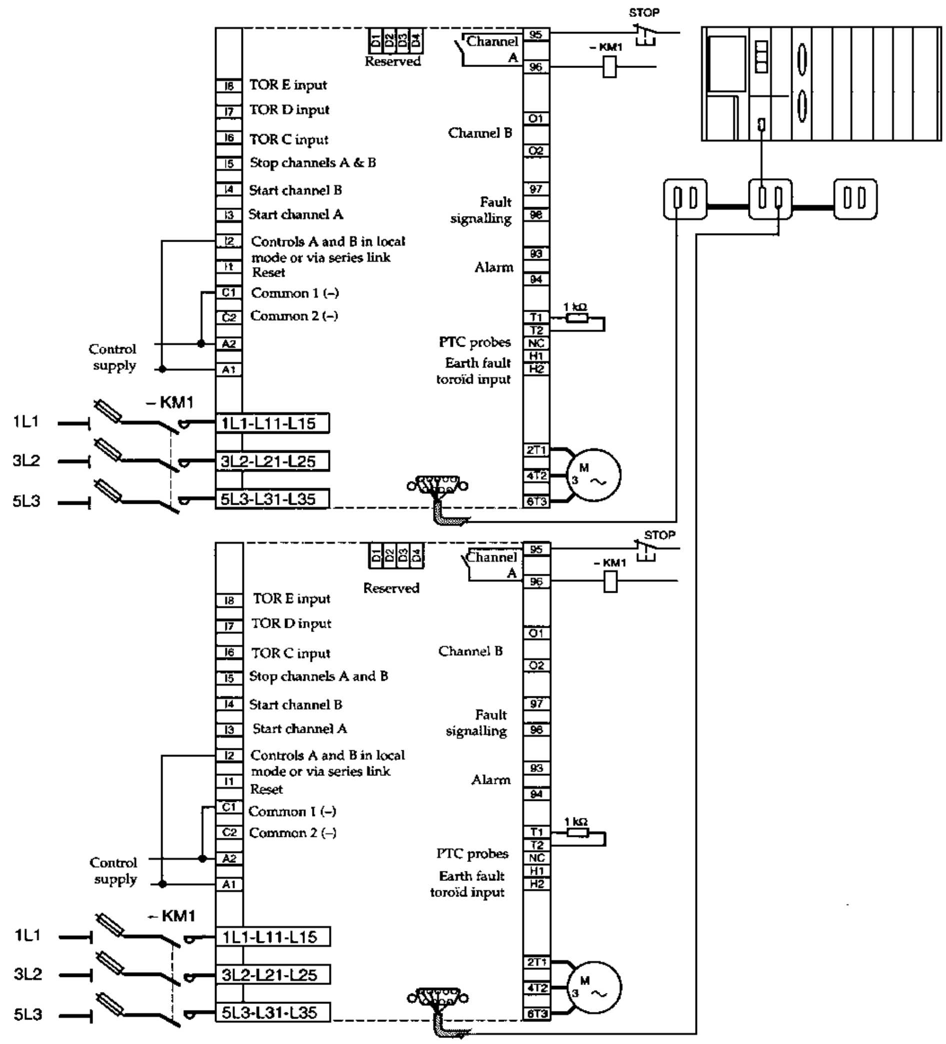


The power contactor (-KM1) is energized and de-energized by the PLC output contacts.

In the event of a fault, contact (95-96) of the LT6 causes the power contactor (-KM1) to de-energize.

Using the serial link, the PLC can interrogate the various LT6 relays and read the measurements available in the database of each LT6.

Using the LT6 as protection, remote measurement, and control relay



The LT6 receives commands from the PLC to control the power contactor (-KM1). The LT6 measures the current per phase, earth leakage (ground fault) current, and the motor temperature rise, and communicates the data to the PLC via the serial link. In the event of a fault, contact (95-96) causes the power contactor (-KM1) to de-energize.

4. Product description and accessories

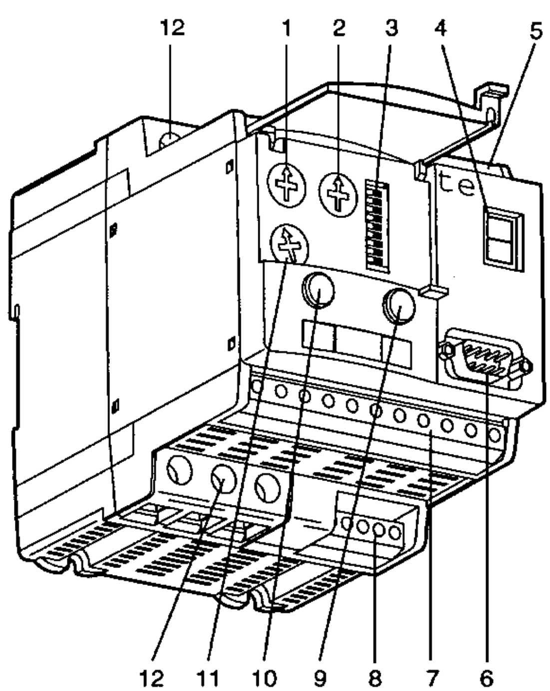
4.1. The products and their operating range:

Reference	Motor FLA Range	Motor Voltage	Control Voltage	Discrete I/O Voltage
LT6P0M005FM	0.2 to 5A	110 to 690 VAC 50/60 Hz	90 to 276 VDC or	90 to 150 VDC or
LT6P0M025FM	5 to 25 A	AC motors only (see note)	90 to 276 VAC 50/60 Hz	90 to 276 VAC 50/60 Hz

For ratings above 25 A, use LT6P0M005FM with external current transformers.

NOTE: The LT6 operates in the frequency range of 50/60 Hz. Outside this range, the accuracy of the LT6 measurements will be affected. The LT6 is not approved for use with DC motors or variable speed drives.

4.2. Presentation of the front face



1, 2 Rotary switches for setting the rated motor current
3 DIP switches for communication configuration
4 7-segment fault display
5 16-pin plug-in input connector
6 SUB-D 9-pin connector for serial link
7 11-pin plug-in output connector
8 5-pin plug-in connector for PTC probe and earth fault toroid terminations
9 Test pushbutton
10 Reset pushbutton
11 Rotary switch for setting the trip class
12 Power terminals

4.2.1. 7-segment display

	Display	Description
Text on the product	0	Running
	1	Alarm
	2	Thermal
	3	PTC
	4	Phase loss
	5	Earth fault
	6	Undercurrent
	7	Over torque
	8	Prolonged starting
	9	Phase reverse
	A	Cos φ
	b	Test button
Explanations in the Technical Manual	C	Watchdog fault
	d	Voltage threshold
	E	Measurement input fault
	F	Parity fault
	H	
	J	Jbus/Modbus fault
	L	
	n	
	P	PTC thermistor short-circuit
	S	
	U	UNI-TELWAY fault (absence of polling)

4.2.2. The DIP switch

On	Off	
	Parity	Address
	16	Address
	8	Address
	4	Address
	2	Address
	1	Address
UNI-TELWAY	JBus/ModBus	
Manual reset	Auto reset	
Line adjust	Local adjust	

NOTE: The positions of the DIP switches are read by the LT6 on power-up only. Any changes made to the DIP switch settings while the LT6 is powered up will not be activated until all power is removed from the LT6 and the LT6 is powered up again.

When the DIP Switch is in the "Local Adjust" position:
- The settings on the front face are used by the LT6.

When the DIP Switch is in the "Line Adjust" position:
- The settings transmitted by the serial communication link are stored in the EEPROM of the LT6.
- The values transmitted by the serial communication link override the settings on the front face.

"Manual Reset - Auto Reset"
(see Section 7.3)

Setting the Address
(See Section 9.1, "The physical layer")

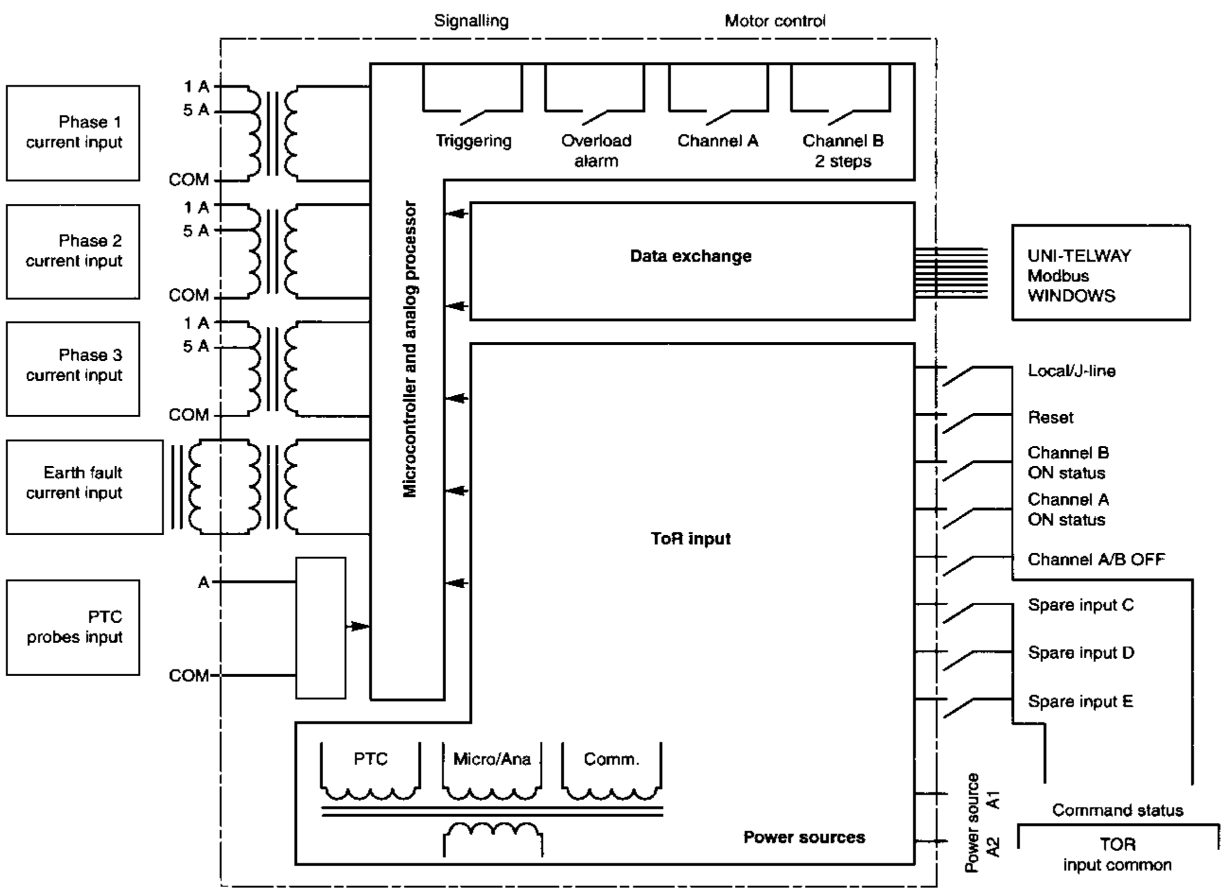
Jbus/Modbus: Address from 1 to 63 using the "parity" switch as address weight 32.

UNI-TELWAY: Address from 1 to 31 using the "parity" switch as parity for address wiring.
Parity = On if the number of address bits is even.
Parity = Off if the number of address bits is odd.

4.2.3 Current and trip class setting switches
(See Section 6.2, "Thermal overload")

4.2.4 TEST and RESET pushbutton (See Section 7.3, "The Reset function")

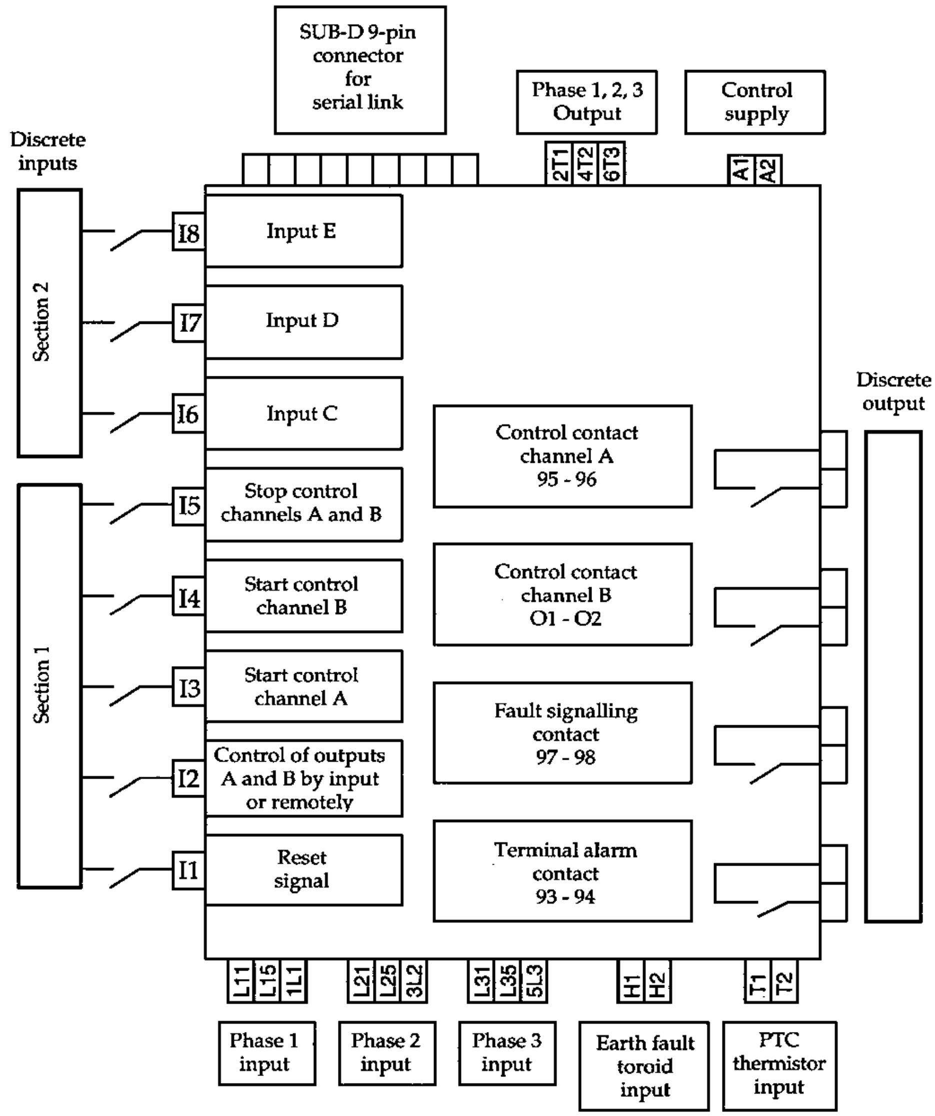
4.3. Product internal circuit diagram



4.4 Information on parameter entry software: LA9P620

This software is to be installed in a PC Windows 3.1 environment.
An interconnection cable forms part of the supply and is used to connect the LT6 to the 9-pin serial link port of the PC (COM1:). To use the software, the DIP switch must be set in the Jbus/Modbus position. The software enables easy access to all the configuration parameters of the LT6 via Windows dialogue boxes (see description in Section 10).

5.1. Discrete inputs (see Section 11 "Characteristics")



- The inputs:
  - The discrete inputs are 90 to 150 VDC (110 VDC ± 20%) and 90 to 276 VAC - 50/60 Hz (110 to 230 VAC ± 20%).
  - The consumption of an input in logic state 1 is at least 1 mA.
  - For an input to be recognized by the software as being in logic state 1, it must be in stable hardware logic state 1 for at least 4 ms.

- The discrete command "Stop channels A and B," which has priority over all other discrete commands, operates in fail-safe "wire broken" mode (off: state 1/on: state 0).

- The inputs are arranged in two groups:
  a. The motor control group: Start channel A, Start channel B, Stop channels A & B, Line/Local, Reset.
  b. The input group: Input C, Input D, Input E. These inputs are free and can be read by serial link (bits 80.5-80.6-80.7).
  - Each of these groups has a separate common (enabling the use of 2 different voltages).
  - Input E is used by the LT6 for voltage measurement (see Section 6.10).

- PTC thermistor inputs:
  - Use of PTC thermistor probes (see Section 6.4, "Thermal Monitoring by PTC Thermistor").
  - If this function is not used, a 1 kΩ resistor (supplied with the product) must be connected across terminals T1 and T2.

- Earth fault sensor inputs:
  - Use of MG earth fault toroids (see Section 6.6, "Earth Fault").

- Auxiliary (control) supply voltage 90 to 276 VDC or 90 to 276 VAC (110 to 230 V ± 20%):
  - The LT6 (aux) is immune to micro-interrupts of duration ≤ 300 ms at a repetition frequency of 0.05 Hz, for utilization at Un.
  - An auxiliary supply voltage < 80 V ± –10% for a time of ≥ 300 ms is considered to be an interruption of the supply voltage.
  - In the event of auxiliary supply voltage interruption, the LT6 stores the setting parameters.

NOTE: A micro-interrupt lasting more than 4 ms causes inputs I5 (A/B channel off) and I2 (local/line) to go to 0 and opens channels A and B.

5.2 Discrete outputs (See Section 11 "Characterisics")

- Channel A and B outputs are electromechanical relay contacts for controlling power contactors.
  - See Section 11 "Characteristics".

- Signalling outputs (alarm and trip) are electromechanical relay contacts:
  - PLC compatibility: minimum level of utilization 5 V, 10 mA.

5.3 Power inputs / outputs (See Section 11 "Characteristics")

- Cabling capacity:
  - Solid cable or stranded cable: 1.5 to 6 mm² (14 to 8 AWG)
  - Stranded cable with cable end: 1.5 to 4 mm² (14 to 10 AWG)
  - Ring tongue terminals (see page 48): internal Ø 2 to 4.2 mm, external Ø 1 to 10 mm.

- Use of external current transformers:
  - Based on IEC 185 and IEC 71 recommendations
  - Input connection 1A (L1-L21-L31) or 5A (L15-L25-L35) depending on the secondary current
  - Minimum power: LT6 consumption = 50 mVA per phase, taking into account the current in the CT secondary, and the resistance of the cable
  - Recommended accuracy limit:
    - Class of accuracy 5P or 10P (error for currents between I_n and 2 I_n: ±1% or ±3%)
    - Phase offset for rated current ± 18 mrd (± 1%)
    - Compound error: 5% or 10%.

NOTE: Use of the measurement transformer: standard, saturation threshold not controlled, suitable for current measurement (I to 2I), and possibly for infrequent starting. Use of protection transformer: specific for motor protection, known saturation threshold, suitable for all motor-starter applications.

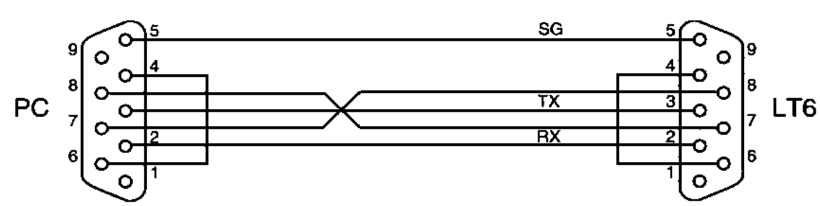
5.4. Serial link

Connection by SUB-D 9-pin connector with RS 232 link (PC link) or RS 485 link (PLC link).

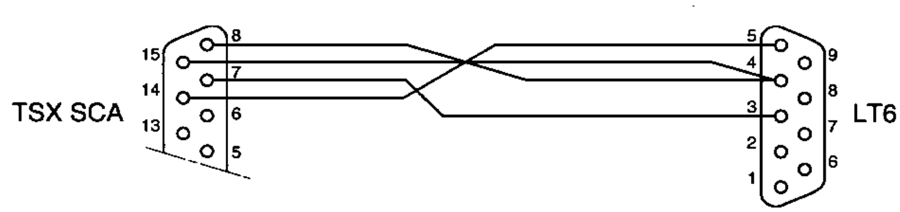
Pin arrangement of the SUB-D 9-pin connector:

Pin	RS 232 Link		RS 485 Link
1			
2	Transmission	(Tx)	
3	Reception	(Rx)	D(A)
4	Data Terminal Ready	(DTR)	OVL
5	Signal Ground	(SG)	D(B)
6	Data Set Ready	(DSR)	
7	Clear To Send	(CTS)	
8	Request To Send	(RTS)	
9			

Connection to PC: reversible cable SUB-D 9-pin female-female connectors (supplied with the LA9P620 Kit).



Connection to PLC: by TSX SCA 62 (2-channel subscriber connector).



SUB-D 15 pin SCA62 SUB-D 9 pin LT6

5.5 Customer connections

Marking of the discrete input terminals

Terminal marking	I1	I2	I3	I4	I5	I6	I7	I8	NC	C1	C2	NC	D1	D2	D3	D4
Description	Reset	Line/ Local	Start A	Start B	Stop A & B	State C	State D	State E		Com Sec 1	Com Sec 2		Reserved			
Description	Section N°1					Section N°2			No Conn	Commons		No Conn				
Description	Discrete inputs															

Marking of the output terminals

Terminal marking	95	96	O1	O2	97	98	93	94	NC	A2	A1
Description	Channel A contact		Channel B contact		Trip		Alarm		No Conn.	Auxiliary (control) supply	

Marking of the terminals for PTC thermistor and earth fault sensor

Sequence number	5	4	3	2	1
Terminal marking	T1	T2	NC	H1	H2
Description	PTC thermistor		No Conn.	Earth fault toroid	

Marking of the power terminals of the LT6P0M005FM

Description	1A current inputs			5A current inputs		
Terminal marking	L11	L21	L31	L15	L25	L35
Terminal marking	2T1	4T2	6T3			
Description	Current output (1&5A)					

Marking of the power terminals of the LT6P0M025FM

Description	Current inputs		
Terminal marking	L11	L21	L31
Terminal marking	2T1	4T2	6T3
Description	Current output		

No Conn. = Terminal not connected

6. Protection functions of the LT6

The following protection functions are only guaranteed if the current in the 3 phases (Irms) is higher than 20% of the current setting (Ir). Otherwise, nuisance tripping may occur.

6.1 Configuration table of the LT6

	Functions		Parameters		
Protection	Parameters preset and enabled at factory	Ability to enable or disable via serial link	Description	Factory settings	Adjustment range accessible via serial link
Thermal overload	YES		Ir (% rating) Overload class Overload alarm	20 % 5 100 % θn	20 to 109 % [1] 5 to 30 [1] 0 to 100 %
Overheating via PTC thermistor	YES			Factory installed 1kΩ resistor	Enable or disable
Phase unbalance and phase failure	YES		Id % 1 rms avg (2) Start inhibit Time before tripping	30 % Iav 0.7 sec 5 sec	10 to 30 % Ir 0 to 10 sec 0 to 10 sec
Earth fault	YES	YES	$I_{\Delta r}$ Time before tripping	30 A 5 sec	0.3 to 30 A 0 to 5 sec
Prolonged starting		YES	I_{sd} (% Ir) Starting time	150 % Ir 10 sec	100 to 500 % Ir 0 to 30 sec
Undercurrent		YES	I_V (% Ir) Time before tripping	30 % Ir 10 sec	30 to 90 % Ir 0 to 30 sec
Torque limitation		YES	I_{LC} (% Ir) Time before tripping	200 % Ir 10 sec	150 to 800 % Ir 0 to 30 sec
Cos ϕ power factor		YES	Cos φ Time before tripping	0.1 10 sec	-1 to 1 0 to 10 sec
Phase rotation direction monitoring		YES	–	Disabled	Enable or disable

[1] These values can be enabled and set on the front of the product.

Complementary functions	Parameters preset and enabled at factory	Ability to enable or disable by serial link	Description	Factory settings	Adjustment range accessible via serial link
Load shedding undervoltage trip		YES	Voltage threshold Time before trip Reset voltage Time before resetting	70 % Un 10 000 sec 90 % Un 10 000 sec	68 to 120 % Un 0 to 100 000 sec 68 to 120 % Un 0 to 100 000 sec
Short-circuit detection	YES		Isc	15 times Ir peak	
Automatic Reset	YES		Time before reset θ°C iron before reset	0 sec 100 % θn	0 to 1 000 s 40 to 100 % θn
Motor control	YES		Control of A and B outputs	Reversing	Reversing independent 2-step (2-speed)
Motor cooling	YES		Cooling method for motor (3)	Self-cooled	Self cooled or external cooled

[2] The average rms current is equal to the average current value of the 3 phases.
[3] Thermal overload reset time is based on calculated cooling time. Cooling time of a self-cooled motor at standstill is four times longer than the cooling time of an externally-cooled motor.

6.2 Thermal overload

The LT6 provides thermal overload protection by monitoring the current drawn by the motor. The LT6 does not monitor heat as done by conventional electro-mechanical overload relays. The current values are converted to thermal values mathematically through algorithms and motor data pre-programmed in the LT6.

The thermal overload function is always enabled. This function cannot be disabled either locally on the front face of the LT6 or by serial link.

The thermal parameters (current settings and overload class) can be adjusted either locally or by line (serial link).

Current settings:
Local Adjust - Dip switch must be in "local adjust" position. The two upper rotary dials on the front face of the LT6 enable the user to set the thermal protection from 20% to 109% of the input power terminals of the LT6 (1 A, 5 A, or 25 A).

NOTE: Do not set the rotary dials to the rated motor full load current (FLC). The dial settings are a percentage of the motor FLC versus the maximum current rating of the LT6 input power terminals used.

Use the following formula to calculate the I_r (%) settings:

$$\frac{I_r\,(A) \times 100}{\text{current transformer ratio}^{[1]} \times \text{LT6 relay rating (A)}} = I_r\,(\%)$$

[1] Ratio of external current transformer = $\frac{\text{Primary input current}}{\text{Secondary input current}}$

For applications without external current transformer, this ratio = 1.

Example of motor rated at 3.7 full load amps:
Since 3.7 A exceeds the 1 A maximum capability of terminals (L11-L21-L31), the input power cabling must be connected to the 5 A current input terminals (L15-L25-L35) of the LT6P0M005FM relay. Using the previous formula:

$$\frac{3.7 \times 100}{1 \times 5} = 74\%$$

Set the top left rotary dial to position 70 and set the top right rotary dial to position 4, for total of 74%.

Example of motor rated at 108 full load amps:
Since 108 A exceeds the 5 A maximum capability of the LT6P0M005FM and the 25 A maximum capability of the LT6P0M025FM, customer provided external current transformers must be used with the LT6P0M005FM relay. Connect power cabling to terminals L11-L21-L31 when using CTs with 1 A secondary, or terminals L15-L25-L35 when using CTs with 5 A secondary outputs.

Assume current transformer ratio = 200:1. Power cabling must be connected to 1 A terminals (L11-L21-L31) of LT6P0M005FM. Using previous formula:

$$\frac{108 \times 100}{200 \times 1} = 54\%$$

Set the top left rotary dial to position 50 and set the top right rotary dial to position 4, for a total of 54%.

Trip class setting

Adjustment of the overload trip class is made by setting the bottom rotary dial to Class 5 (10 A), 10, 15, 20, 25, or 30. The following cold and hot motor conditions apply.

• IEC 947-4 § 7.2.1.5.1 case e)

Motor state	I/I_r	(5) 10A	10	20	30	⇒ Class
Cold	7.2	$2<T\leq10$	$4<T\leq10$	$6<T\leq 20$	$9<T\leq30$	⇒ Tripping time (sec)

• CEI 947-4 § 7.2.1.5.1 case c) and d) class 5 = class 10A

Motor state	I/I_r	(5) 10A	10	20	30	⇒ Class
Hot	1.5	< 120	< 240	< 480	< 720	⇒ Tripping time (sec)

NOTE: Class 15 has trip times between Class 10 and 20; Class 25 has trip times between Class 20 and 30.

Characteristics

The product conforms to standards IEC 947-4 and IEC 255-8.
The relay responds to one of the I^2t laws (copper/iron, etc.).
For the calculations, the value of current used is the true RMS value (including harmonics).

Line Adjust by serial communication line (words 84-85-bit 100.F). The DIP switch must be in the "Line adjust" position. Factory default settings are preset at 20% I_r and Class 5. Settings may be changed by serial link on "Settings" screen of the LT6P620 Windows software that enables the user to:

- Set the LT6 to the % of rated current
- Set the overload trip class
- Declare the motor to be "self-cooled."

NOTES:

- *Although the local settings on the front face of the LT6 and the line settings on the software may be different, the LT6 relay will operate according to the position ("Local adjust" or "Line adjust") of the DIP switch when the LT6 was powered up.*

- *The long iron time constant has a tripping threshold equal to 125% of θn.*
  The short copper time constant has a tripping threshold equal to 200% of θn.
  Measurement accuracy (product only) over a range from 0.3 I_r min. to 8 I_r max. is better than ±4% (from -25 to + 70 °C) at nominal frequencies of 50/60 Hz.

- *The LT6 uses the current draw at power loss to calculate a cool-down/reset time. When this time has elapsed and power is restored, the device will reset. If the power loss exceeds 20 minutes, cool down/ reset time is considered complete and reset will occur when power is restored.*

6.3 Thermal overload alarm

This function can be used to activate a pilot light when the current draw of the motor exceeds a preset threshold value. It is accessed by discrete output 93-94 or by bit 80,F. This function is always enabled.

Make adjustments via the communication line (word 86):

- Setting the value of the overload threshold from 0 to 100% of the nominal iron thermal state during typical running mode in steps of 1%. Setting to 0% provides a contact which is closed on power up. This contact opens in the event of a product fault or loss of the auxiliary power supply.

Initial state of the product:

- The value of the overload threshold is set to 100% of θn iron.

6.4 Thermal monitoring by PTC thermistor

This function enables thermal monitoring of the motor by built-in PTC thermistor probes. For selection of PTC thermistors, see Section 13.

This function is disabled at the factory with a 1 kΩ resistor across terminals T1-T2 that prevents the product from tripping on infinite resistance.

To enable this function, remove the resistor and connect PTC thermistors.

The following standards apply when selecting PTC thermistors:

Thermistor marked A IEC 34-11 (for 3 probes < 250 Ω in series)

- Trip values: > 4,000 ohms.
- Tripping range: 1650 to 4000 ohms.
- Resetting range: 1650 to 750 ohms.
- Reset values: < 750 ohms.

Product characteristics:

The configuration below enables the connection of up to 6 probes in series in the same circuit while conforming to the standard (except that the total resistance of the probes circuit will be < 1500 ohms).

- Tripping on open circuit detection: this function is assured by the trip function.
- Trip values: 2900 ohms ± 200 ohms.
- Reset values: 1575 ohms ± 75 ohms.
- Short-circuit detection trip: 17 ohms ± 3 ohms.
- Short-circuit detection reset: 24 ohms ± 3 ohms.
- Tripping time (event →action) is > 500 ms (interference suppression) and ≤ 600 ms.

NOTE: Do not use PT100 probes. They do not meet appropriate standards.

6.5 Phase unbalance and phase loss

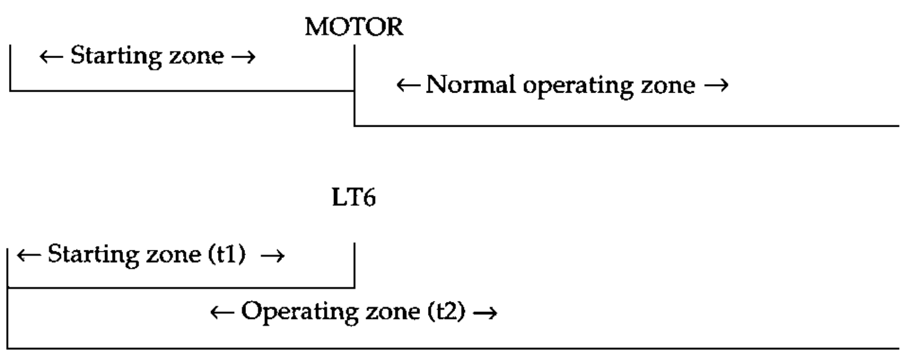
This function monitors the symmetry of the rms currents in the phases and causes the LT6 to trip above a phase unbalance threshold after a preset time delay.

Enable, disable, or make adjustments via communication line (words 87-88-89):

- The phase unbalance threshold is from 10 to 30% of Iav in steps of 1%.
- The acceptable unbalance time before tripping (t2) is adjustable from 0 to 10 seconds in steps of 0.1 second.
- On motor starting, the time before tripping (t1) is from 0 to 10 seconds in steps of 0.1 second.

This dual adjustment enables fast tripping on starting in the event of phase loss and thus prevents the motor from starting in the wrong direction (e.g., in the case of driving loads).

- Zones covered by the time delay:



Factory Settings:

- This function is enabled.
- Tripping on phase unbalance is preset to 30% of I_r.
- t2 = 5.0 seconds.
- On motor starting: t1 = 0.7 seconds.

Characteristics:

- The accuracy of the tripping time is ± 0.1 second.
- Unbalance is calculated between the highest I_{rms} of the 3 phases and I_{av}.

6.6 Earth fault

This function monitors insulation faults by an earth fault toroid.

Enable, disable, or make adjustments via communication line (words 90-91):

This function enables the user to adjust:

- Sensitivity from 0.3 to 30 A in steps of 0.1 A.
- The tripping time delay from 0.1 to 5 seconds in steps of 0.1 seconds.
- A command can be used to inhibit this function (bit 110,3).

Factory Settings:

- This function is enabled.
- Sensitivity = 30 A and tripping time delay = 5 seconds.

Characteristics:

- Conforms to standard IEC 755 (class TB).
- Sensitivity is from 0.3 to 30 A ($I_{\Delta r}$).
- Maximum tripping times are $I_\Delta / I_{\Delta r} = 1 \Rightarrow 5$ s; $I_\Delta / I_{\Delta r} \geq 2 \Rightarrow 0.1$ sec.
- Non operation for 0.5 $I_{\Delta r}$ and for $I \geq 6\ I_r$.
- The accuracy of this measuring chain $I_\Delta / I_{\Delta r}$ is less than 10% from 0.3 to 30 A ($I_{\Delta r}$ max).
- The accuracy of the tripping time is ± 0.1 sec.

NOTES:
- *To ensure the safety of personnel, using a differential relay type Vigirex from Merlin Gerin is recommended.*
- *The LT6 does not meet the standard for Class TA: residual currents of 30 mA and tripping time for $I_\Delta / I_{\Delta r} = 5 \Rightarrow 0.04$ second.*

6.7 Undercurrent

This function reads the motor current values and trips the LT6 at a set time if the current is below a preset threshold value. This function can be used to monitor the draining of pumps, unloading of conveyors, broken belts, etc.

Enable, disable, or make adjustments via the communication line (words 94 - 95):

- The tripping threshold Iv from 30% to 90% of Ir in steps of 1%.
- The permissible time before tripping from 0 to 30 seconds in steps of 0.1 sec.
- A command can be used to enable this function (bit 110,4).

Characteristics:

The undercurrent value is defined by the ratio I_{max} / I_r.

6.8 Prolonged starting

This function allows the user to extend the motor start-up to a maximum of 30 seconds. The LT6 monitors the motor current and trips after a set time delay if the current exceeds a preset current value.

Enable, disable, or make adjustments via the communication line (words 92 - 93):

This function enables the user:
- To adjust the starting time from 0 to 30 seconds in steps of 0.1 sec.
- To adjust the current at the end of starting: Isd from 100% to 500% of Ir in steps of 1% of Ir
- To enable this function (bit 110,6).

Factory Settings:
- The function is disabled.
- Tripping time delay is equal to 10 seconds.
- Current Isd is preset to 150% of I_r.

Characteristics:

The accuracy of the tripping time is ±0.1 seconds.

6.9 Overtorque (locked rotor)

This function monitors the motor current values and trips the LT6 at a preset time if the current exceeds a preset threshold after the motor has passed the normal starting period. This function is also called jam protection. Typical applications are for rock crushers.

Enable, disable, and make adjustments via the communication line (words 96 - 97):

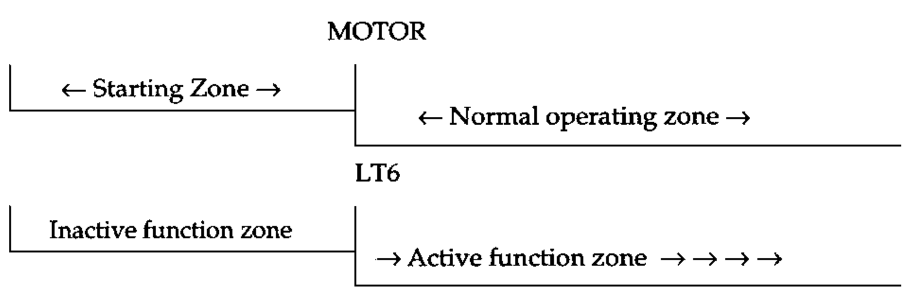
- The tripping threshold (I_{LC}) is from 150% to 800% of Ir in steps of 1% of Ir.
- The permissible time before tripping is from 0 to 30 seconds in steps of 0.1 sec.
- A command can be used to enable this function (bit 110,5).

Factory settings:

- The function is disabled.
- The tripping time is equal to 10 seconds.
- The tripping threshold (I_{LC}) at 200% of Ir.

Characteristics

Calculation of the torque limitation current.
- The accuracy of the tripping time is ± 0.1 seconds.
- Zone covered by the time delay:



6.10 Monitoring cos φ (power factor) and voltage and frequency measurement

This function monitors the difference in phase angle between the motor current and the motor voltage.

The voltage measurement enables the user to:
- Improve undercurrent (underload) monitoring
- Make an evaluation of power (with the measurement of the voltage)

Enable, disable, and make adjustments via the communication line (words 98 - 99):

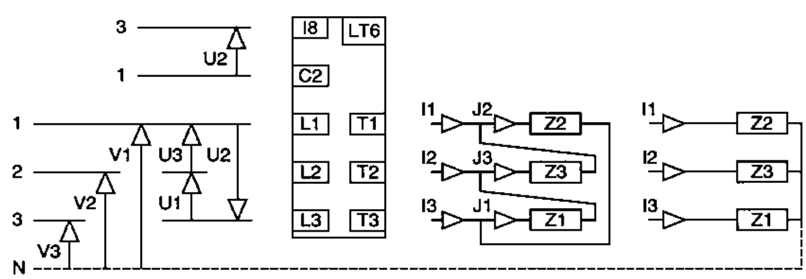
- The tripping threshold of cos φ is adjustable from - 1 to + 1 in steps of 0.01.
- The tripping time for cos φ is adjustable from 0 to 10 seconds in steps of 0.1 sec.
- The function can be enabled via the line (bit 110,8).

Factory settings:

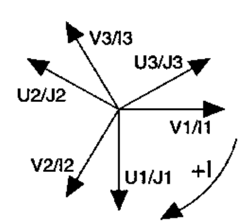
- The function is disabled.
- The tripping threshold for cos φ is 0.
- The tripping time is equal to 10 seconds.

Characteristics:

- Voltage measurement is carried out via the discrete input E (I8). This input receives an image of the voltage U2 (taken between L1 and L3) and the current I3. It is calibrated from 150 to 276 V (68% to 120%) where 100% = 230 V.
- The LT6 recognizes the direction of phase rotation and corrects as a consequence.
- If the current is measured using a CT, the phase difference caused is not corrected as the accuracy of the CT is better than ±18 mrd (±1°).
- If the voltage is derived from a voltage transformer, the wires of the secondary must be changed over to cancel the phase difference (π).
- The LT6 does not correct phase differences that are due to the connection of the relay in the motor windings.
- The reference system for the calculation is as follows:



Rotation reference



The accuracy of measuring cos φ is ±3° at nominal voltage, with a deviation of 5% over 10 years.

Measurement of the voltage and frequency (words 74-75):

- The accuracy of voltage measurement is ± 5% at rated voltage, with a deviation of 5% over 10 years.
- The accuracy of frequency measurement is ±2%.

6.11 Phase reverse

This function monitors the direction of rotation of the protected motor and trips the LT6 if phase reversal is detected.

Case of "reverser" programming:
Phases L1, L2, L3 (or any circular permutation) are assigned respectively to inputs L11, L21, L31 of the LT6 when channel A is commanded, and to L21, L11, L31 (or any circular permutation) when channel B is commanded.

Case of "2-step" or "independent" programming:
Phases L1, L2, L3 (or any circular permutation) are assigned respectively to inputs L1, L2, L3 of the LT6.

Enable or disable via the communication line:

This function can be enabled by the line (bit 110, 7).

Factory settings:

- The function is disabled.

Characteristics:

- The direction of phase rotation is monitored by reading the current in each phase.
- A direction of rotation other than that selected trips the relay.
- Tripping time (event →action) is > 100 ms (interference suppression) and < 300 ms.

7. Tripping and reset conditions

7.1. Tripping of the LT6 relay

The protection functions which trip the product are:

1	- Thermal trip (iron) stator	5	- Earth fault	9	- Phase Reverse
2	- Thermal trip (copper) windings	6	- Undercurrent	10	- Cos φ
3	- PTC thermistor	7	- Overtorque	11	- Test button
4	- Phase unbalance and phase loss	8	- Prolonged starting		

In these cases, Channels A (95-96) and B (01-02) open and the trip signalling contact (97-98) closes. The LT6 is in the stop condition, i.e., "Start channel A" bit and "Start channel B" bit equal to zero (bits 83,0 to 83,3).

- If a second fault occurs prior to resetting the LT6 after an initial fault, both A and B channels will open. The LT6 reacts in the following manner:
  - The 7-segment display signals the first cause of tripping, together with bits 81,0 to 81,F.
  - The register of the last 5 trips signals all the trips (1st, 2nd,etc.) (the fault code given above from 1 to 11 is written in word 0).

7.2. LT6 relay fault

The functions which cause the LT6 to trip and show an LT6 product fault are:

13	- Watchdog	14	- Measurement input	15	- PTC thermistor short-circuit

In these cases, Channels A (95-96) and B (01-02) open and the trip signalling contact (97-98) closes. The LT6 is in the stop condition, i.e., "Start channel A" bit and "Start channel B" bit equal to zero (the fault code given above from 13 to 15 is written in word 0).

7.3. The RESET function of the LT6

- Any trip or fault occurence requires a "Reset" function. Without a "Reset", channels A and B, which operate the power contactors, cannot be restarted.
- The type of reset (Manual/Auto) is defined by the DIP switch on the front face of the LT6.
- "Auto Reset": The LT6 resets itself after the motor has cooled only if the LT6 tripped on thermal overload. Any other type of trip must be reset manually after the fault has been cleared.

- "Manual Reset": The LT6 can only be reset by a "Reset" operation. Reset can only occur by a sequence from state 0 to state 1. Blocking (holding down) the "Reset" button does not prevent tripping. Resetting can be done by three methods:

  1 - Press the "Reset" button on the front face of the LT6, (this button can be disabled by a command on the "status" window of the LA9P620 software).
  2 - Via the communication line (if discrete input I2 = 1) by activating bit 83, 2 (click the "Reset" button on the "Status" window of the LA9P620 software).
  3 - Discrete input signal to "Reset" input I1 (if discrete input I2 = 0).

- *NOTE: Loss of supply voltage, even if prolonged, does not cause the relay to reset. In this case, the cause of tripping is stored (product display and bits 81,0 to 81,F).*

- "Reset" is only enabled if:

  1 - The thermal state (iron and copper) is less than a value programmable from 40 to 100% of θn in steps of 1%. The initial state of the value is 100% (word 105).
  2 - At the end of a time delay programmable from 0 to 1000 seconds in steps of 10 s. This time delay is initiated immediately after tripping and has an initial value of zero (word 104).
  3 - The LT6 calculates the time needed for a reset to be enabled. The longest time (thermal state or time delay) can be accessed in word 72 "Time before reset enabled". This value is refreshed every second.

7.4. Setting and clearing the alarm

The "thermal overload alarm" will close output 93-94 and bit 80, F prior to thermal overload trip (see Section 6.3). Any function which exceeds its parameter setting without exceeding its tripping time (phase unbalance, earth fault, undercurrent, torque limitation, cos φ functions) will also cause the thermal overload alarm to set. The 7-segment display will only indicate a "1" or alarm status.

Example: The phase unbalance and phase loss function is programmed with a threshold of 10% and a tripping time of 10 sec.

------------- Unbalance greater than 10% ------------->										
Alarm					Trip					
t = 0 s	2	4	6	8	t = 10 s	11	12	13	14	15

The corresponding "alarm" bit is set to 1 for the duration of the alarm (bits 82,0 to 82,5).

NOTE: The 7-segment display shows only the thermal overload alarm.

The alarm bit will reset as soon as the alarm condition is cleared.

7.5. TEST function

This function tests the tripping operation of the LT6 by simulating a fault condition.
This function can be carried out:
- Locally by pressing the "Test" pushbutton on the front face of the LT6.
- Using the communication line by activating bit 83,3 (click "reset" button on the "commands" screen of the LA9P620 software).

Performing a test causes channels A and B to open, and the fault signalling contact to close.

8. Description of complementary functions

8.1. Motor control

The LT6 can be used as the control interface for the motor it protects.

8.1.1. The motor control discrete I/O

- Two outputs of the LT6 (channel A and channel B) can be used to control 2 motor line contactors (*e.g.*, Controlling a reverser).
- Two inputs can receive the status of the motor line contactors (channels C and D).
- Three inputs (start channel A, start channel B, and stop channels A and B) can be used to control the motor line contactors (in local control).

8.1.2. Choice of motor control

Discrete input I2 can be used to select "line" (state 1, supply on) or "local" (state 0, supply off).

- "Local": Three discrete inputs (I3, I4, I5) can be used to control channels A and B. The communication line can be used to read the state of the inputs, but has no effect on the control of the channel A and B outputs.
- "Line": The communication line can be used to control channels A and B (bits 83,0 and 83,1) and to read the state of the inputs (bits 80,0 to 80,7). Three discrete inputs (I3, I4, I5) have no effect on the control of the channel A and B outputs.

Changing selection "Local" to "Line" or "Line" to "Local" will trip the LT6 and stop both channels A and B simultaneously.

8.1.3. Choice of operation of channels A and B

The following operating modes for channels A and B may be selected via the serial link:

"Reverser": Channels A and B cannot be activated at the same time. To start one of the two channels both channels must be inactive and Imax/Ir < 0.2 for a time greater than 100 ms. This prevents closing channel B to reverse the direction of the motor until channel A, the forward contactor, has been de-energized.

"2-step ": Channels A and B are commanded for 2-step (2-speed) starting of the controlled motor. In this case, the "start channel B" command is inoperative. Any interruption of the cycle below sets the cycle to step 1).

1) $I_{max}/I_r < 0.2$ for a time ≥ 2 s — "Motor stopped"
2) $I_{max}/I_r > 0.2$ — "Beginning of starting"
3) ($I_{max}/I_r >$ Isd then $I_{max}/I_r <$ Isd) or (Delay >1.5 x Class) — "End of 1st starting time"
4) Opening of A
5) $I_{max}/I_r < 0.2$ for a time ≥ 0.1 s
6) Closing of B
7) $I_{max}/I_r > 0.2$ — "Start of 2nd step"
8) ($I_{max}/I_r >$ Isd then $I_{max}/I_r <$ Isd) or (Delay >1.5 x Class) — "End of starting"

This mode of operation can be used for star-delta, part-winding, primary resistor starting, etc.

"Independent" : Channels A and B are independent and can be commanded at the same time or separately.

- Only one mode of operation is enabled at a time.
- In the event of conflict, the order of priority is: 1 = reverser - 2 = independent - 3 = 2-step.
  e.g., request reverser and independent ⇒ reverser
  request independent with reverser already active ⇒ reverser
- A change in operating mode can only be made when channels A and B are not activated.
- The initial state of the product is "reverser". The change can be carried out via the communication line (bits 110,A - 110,B - 110,C).
- The discrete command "stop channels A and B" stops both channels simultaneously when the product is in local mode.
- A trip, a stop command, or an auxiliary supply interrupt opens "channel A and B" regardless of the mode "line" or "local."
- A "Reset," the reappearance of the supply voltage, etc..., do not constitute a command to close channel A or channel B. For channels A or B to be switched on, the start signal must be present.
- If discrete inputs "start channel A" and "stop channel A & B" are set to 1, a "reset" or the appearance of the auxiliary supply causes "reverser", " independent" or "2-step" operation as described above. The same applies to channel B.
- A stop signal or a stop condition for channels A and B always has priority over one or more start signals for channels A and B.

8.2. Motor maintenance

To provide motor maintenance data, the following parameters are available.

8.2.1. The last 5 trips

Saved in the EEPROM, the last S trips are managed in the form of a shift register (first in / first out) with 5 files. They are available in words 0 to 49.

- Content of a file:

Description
Cause of tripping
Long thermal time constant (iron)
Short thermal time constant (copper)
Rms current phase 1
Rms current phase 2
Rms current phase 3
Unbalance current I_d
Value $I_{\Delta r}$ (Earth fault)
Cos φ
Voltage

- The values in the files are the values at the time the LT6 trips.

- Trip cause codes:
  (bits 81,1 to 81,F)

Description	
Iron thermal trip	1
Copper thermal trip	2
PTC thermistor	3
Phase unbalance and loss	4
Earth fault	5
Undercurrent	6
Torque limitation	7
Prolonged starting	8
Direction of rotation	9
Cos φ trip	10
Test button	11
Watchdog fault	13
Measurement input fault	14
PTC thermistor short-circuit	15

8.2.2. Trip cause counters

- These are stored in the E^2PROM memory.
  List of counters:
  (words 50 to 60)

Description
Iron thermal trip
Copper thermal trip
PTC thermistor
Phase unbalance and loss
Earth fault
Undercurrent
Prolonged starting
Torque limitation
Direction of rotation
Test button
Cos φ

When the value of a counter reaches $7FFF_h$ (32767) it changes automatically to 0000_h (0).
Bit 83,D set to 1 by the user enables the counters to be reset. The LT6 automatically resets this word to 0.

8.2.3. The motor line utilization counters

- List of counters:
  (words 61 to 64)

Description
Number of starts
Motor operating time
Number of channel A closing ops
Number of channel B closing ops

- Number of starts: As defined in the section 8.1.3.
- Operating time:
  - Time during which $I > 0.2\ I_r$.
  - The resolution is 1 second.
  - Every 3600 seconds, 1 hour is added to the hours counter in the E^2PROM.
  - Each time the auxiliary supply is switched off it is accepted that the RAM loses the contents of the seconds counter.
  - When the value of an E^2PROM counter reaches $7FFF_h$ (32767) it automatically changes to 0000_h (0).

- Number of channel A, channel B closing operations and number of motor starts.
  - Each time channel A or channel B closes the corresponding E^2PROM counter is incremented.
  - When the value of an E^2PROM counter reaches $7FFF_h$ (32767) it automatically changes to 0000_h (0). Bit 83,E set to 1 by the user enables the counters to be reset. The LT6 automatically sets this word to 0.

8.2.4. Actual values

The following values can be accessed for actual value (refreshed every second)

- Content of the measurements: (words 65 to 75)

Designation
Long thermal constant (iron)
Short thermal constant (copper)
Rms current phase 1
Rms current phase 2
Rms current phase 3
Unbalance current I_d
Value $I_{\Delta r}$ (Earth fault)
Time before Reset enabled
Cos φ
Voltage
Frequency

8.3. Load shedding (undervoltage trip)

This function enables deactivation of non-priority system functions by opening channels A and B of the LT6 if the voltage drops below a certain threshold.

NOTE: This function requires the voltage to be measured by the LT6 (see Section 6.10).

Enable, disable, and adjust via the communication line (words 100 to 103):

- The undervoltage and reconnection thresholds from 68% to 120% of Un in steps of 1% .
- The times before undervoltage and reconnection. From 0 to 100,000 sec in steps of 10 sec (24 hours).

Factory settings:

- The function is disabled.
- The times before undervoltage and reconnection are set to 10,000 sec.
- The undervoltage threshold is set to 70% of Un.
- The reconnection threshold is set to 90% of Un.

Characteristics:

- Undervoltage:
  - When the voltage reaches the load shedding threshold level, the corresponding alarm is activated.
  - If the voltage level remains below the load shedding threshold for the programmed time, channels A and B open.
  - This function is enabled even with channels A and B off: if a start signal arrives when the product is in undervoltage condition, the signal is stored and the reconnection function will execute the stored signal.
  - This state is signalled by bit 80,B.

- Reconnection:
  - When the voltage reaches the reconnection threshold level:
    . the corresponding alarm is stopped.
    . If the voltage level remains above the reconnection threshold for the programmed time, channels A and B will close if they have a "Run" signal.
  - Reconnection takes into account the selected operation: "reverser," "independent" or "2-step".

- Operation of the data base variables:
  - Bits 80,C and 80,D store the start/stop signals coming from the communication line (bits 83,0 and 83,1) or the discrete inputs (bits 80,0, 80,1 and 80,2).

Undervoltage ⇒
- Bits 80,C and 80,D are unchanged.The setting to 1 of 80,B means that 95-96 and O1-O2 output contacts are open.

During undervoltage time ⇒
- Bits 80,C and 80,D can be controlled (0 or 1) but 95-96 and O1-O2 output contacts remain open. Bit 80,B = 1.

Reconnection ⇒
- Closing or 2-step starting depending on bits 80,C and 80,D and 110, A, B, C.
- The reconnection threshold must be ≥ the undervoltage threshold.

8.4. Short-circuit detection

This function enables short-circuit signalling

- This function is always enabled.
- Short-circuit detection threshold: I_{SC} = 15 x Ir peak detected on one of the three phases.
- The accuracy of the value of I_{SC} is ≥ 20%.
- The short-circuit detection word (bit 78,2) is activated as soon as the fault appears and is acknowledged when it is read.

8.5. Monitoring function

Monitoring systems, built into the product, constantly check the correct operation of the LT6, and immediately control the opening of channels A and B in the event of failure.

- "Watchdog"

The LT6 has a "Watchdog" independent of the microprocessor which operates on transitions.
The microprocessor saves the parameters in E^2PROM each time they are modified.
(Parameters: configuration of the LT6: words 84 to 110).

Tripping the watchdog activates the microprocessor reset.

If the microprocessor does not restart, all the outputs receive a signal to open.
The watchdog reiterates the resets until the LT6 can reinitialize.
The thermal state is 1 by default.
No output will be activated without a signal
The parameters are reset to the values saved if these values are reliable.
The "watchdog" bit (78,7) is set to 1.
If the values saved <u>are not reliable</u> the LT6 takes the initial values in ROM and the values on the front face (I_r and class).
In this case the thermal state by default is 1.
Use of the initial state is signalled by the "initial state" bit being set to 1 (bit 79,F).

NOTE: Setting bit 79, F to 1 does not prevent new parameters being entered.
Bit 83,F set to 1 by the user enables loading of the initial values (with stopping of channels A and B).

- **"Analog input monitoring"**

• The LT6 checks the coherence of its analog inputs.

• Each analog measurement has two inputs on the micro controller: a direct input and an amplified input which is used to measure low values. The LT6 regularly checks the coherence of the values read on these two inputs.

• If 10 successive measurements are not coherent, a signal is given to open all the outputs.

• The "measurement input fault" word is set to 1 (bit 81,E).

9. The LT6 communication function

9.1. The physical layer

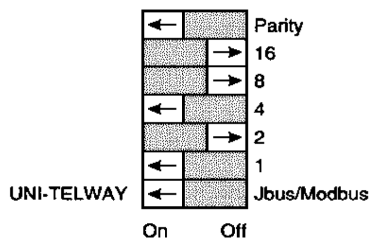
Two physical standards are supported through the same SUB-D 9-pin connector on the front face of the LT6:

• RS 485
• RS 232
(Circuit isolated from the other LT6 relay functions).

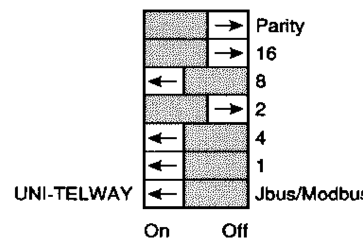
2. Configuration of the communication line

Each LT6 used in a network must be assigned a unique numerical address.

• The station address is defined by 6 switches on the front face of the LT6:
  - Setting address for UNI-TELWAY protocol: Address 1 to 31 may be assigned.



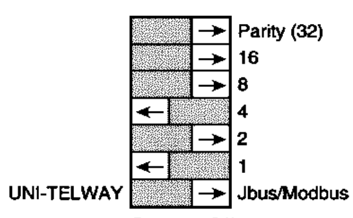
Address = 5



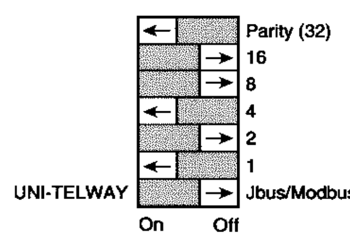
Address = 11

NOTE: Parity switch should be in the "on"position if UNI-TELWAY station address is set by placing an even number of DIP switches in the "on" position. For example, address 5 consists of two switches (4 and 1) an even quantity of switches.

- Setting address for Jbus/Modbus protocol: Address 1 to 63 may be assigned.



Address = 5



Address = 37

NOTE: Set "parity" DIP switch to "on" for address value 32.

The address is recognized by the LT6 during power up. If the address is changed when the LT6 supply is on, it is necessary to power down the LT6 and then power up the LT6 for the new address to be recognized.

• The protocol (UNI-TELWAY or Jbus/Modbus) is defined by a switch on the front face of the LT6.

• Two transmission speeds are possible (4800 and 9600 bits/sec) and are automatically recognized by the LT6.

9.2. Communication protocol:

Two protocols:
- UNI-TELWAY
- Jbus/ Modbus

The LT6 will recognize both protocols.

1. Characteristics of UNI-TELWAY protocol:

Connection: SUB-D 9-pin male
Address: one only per product, from 1 to 31 with configuration by switch on the front of the product
Speed: automatic recognition (4800 or 9600 bits/s)
Number of messages stored on reception: 3
Number of messages stored on transmission: 0
Detection of absence of polling: more than 3 sec.

Type of object recognized	Byte (8 bits)	Word (16 bits)	Signed integer (16 bits)
segment	104	104	104
type of object	6	7	7
maximum size	218	109	109
min address max address	W0 W110	W0 W110	W0 W110
read access read/write access	W0 to W110 W83 to W110	W0 to W110 W83 to W110	W0 to W110 W83 to W110

UNI-TELWAY request codes:

Family	Service	Request		Confirm		Description
		Hex	Dec	Hex	Dec	
Access to data	Read a word	04	04	34	52	(W)
	Read objects	36	54	66	102	Bit, word, bit or word strings
	Write a word	14	20	FE	254	(W)
	Write objects	37	55	FE	254	Bit, word, bit or word strings
Unsolicited data	Unsolicited data	FC	252	-	-	Sends data without first receiving a request 26 - 01 - 1.02 - LT6P
General use	Device identification	0F	15	3F	63	Gives the type of product, the version and the commercial reference
	Protocol version	30	48	60	96	
	Status	31	49	61	97	Status of a device
	Mirror	FA	250	FB	251	Test of system and the communication path
	Read error counters	A2	162	D2	210	For device communication fault
	Reset counters	A4	164	FE	254	Reset

Unsolicited data
- The LT6 informs the master of all trips or alarms by sending unsolicited data.
- The unsolicited data is the record of the last trip.
- This message is sent to a "text block" in the master.
- The number of the text block is written in word N°106.
- This function is only enabled if word 98 is >-1 and <33.
- The initial value of word 106 is "-1".
- The destination address of the text block is: Network = 0; Station = 254; Gate = text block address + 16 (decimal).
- Since the data is not acknowledged by the master, it is repeated three times with one transmission every 3 seconds.

2. Characteristics of Jbus/Modbus protocol:

Connection: SUB-D 9-pin male (included in LA9P620 kit).
Address: one only per product from 1 to 63 with configuration by switch on the front of the product
Speed: automatic recognition (4800 or 9600 bits/sec)
Transmission parameters: 1 start bit, 8 data bits, 1 stop bit, no parity, 9600 or 4800 bits/sec.
Separation time:
- 2 characters of one message: less than the transmission time for 3 characters
- 2 messages: greater than the transmission time for 3 characters

Jbus/Modbus frame: RTU Mode

The frame defined for Jbus/Modbus protocol does not include message header or end of message bytes. Its definition is as follows:

address	request	data	CRC 16

Data is transmitted in binary.
CRC 16: cyclical redundancy check.
Detection of the end of the frame is by a silence longer than or equal to 3 characters.

Jbus/Modbus functions:

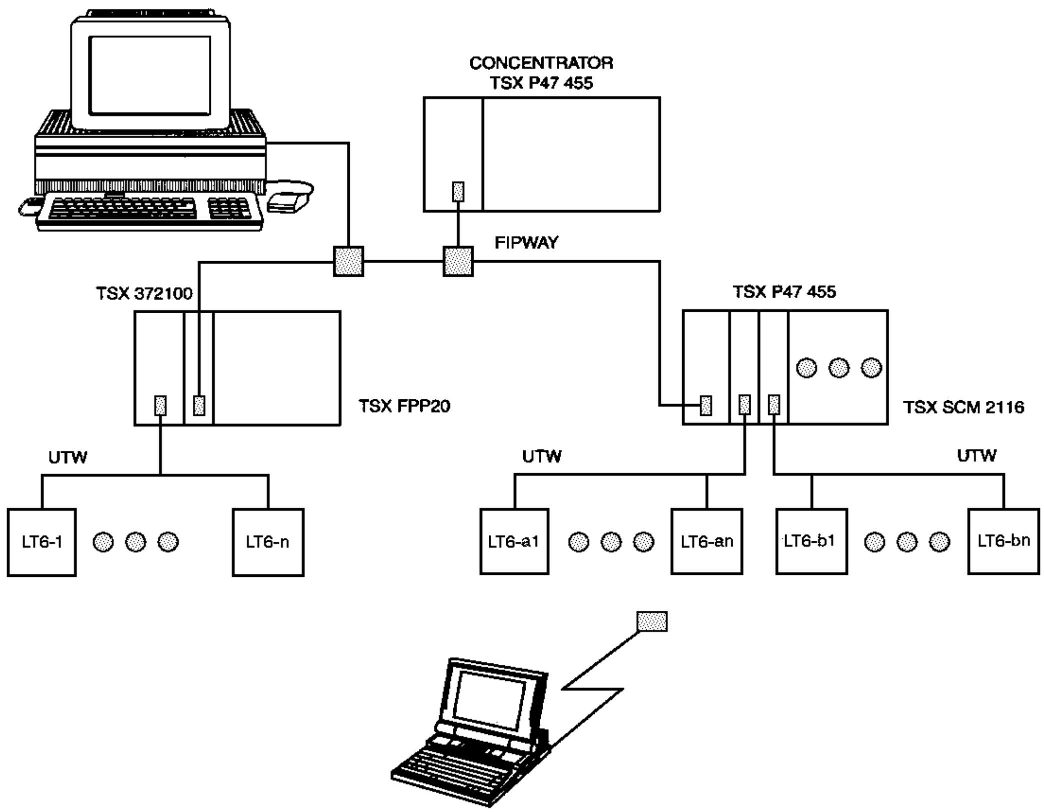
These can be broken down into:
- Main functions used for data exchange,
- Complementary functions for exchange diagnostics.

Code	Function Types	D	Maximum number of words
03	Read N output words (W0 to W110)		111
04	Read N input words (W0 to W110)		111
06	Write an output word	D	
08	Diagnostic with subcodes 00, 0A, 0B, 0C, 0D, 0E, 0F, 10, 11, 12		
11	Read events counter		
16	Write N output words	D	

The functions marked "D" can be used for general dissemination (Broadcast).
The message transmitted by the master must then specify slave number 0.
No acknowledgement is sent.

9.3. Architecture Examples

9.3.1. UNI-TELWAY architecture



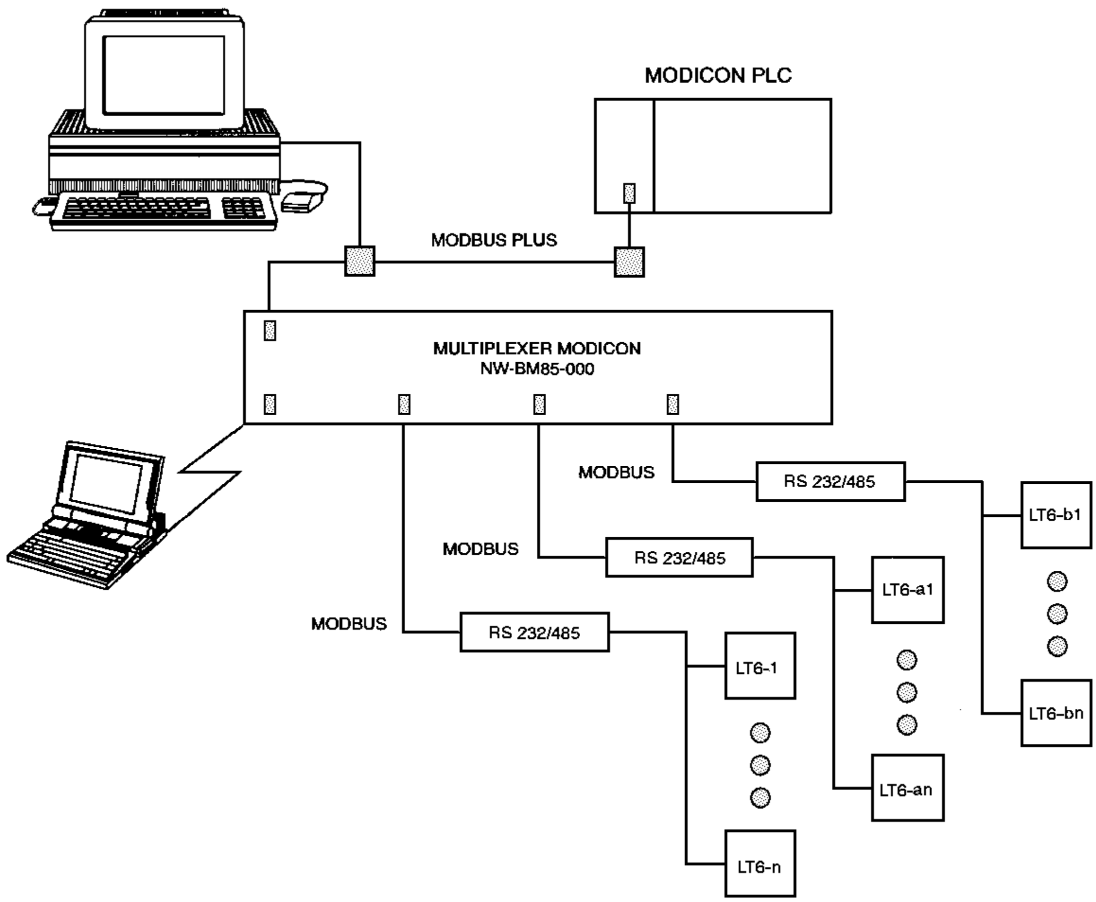
References for connection to UNI-TELWAY bus and TELEMECANIQUE programmable controllers

- Screened twisted pair cable: TSX SCA 100 (200, 500)
- Tap-off box: TSX SCA 50
- 2-channel subscriber connector: TSX SCA 62

- Communication coupler
  * for TSX 17-20 PLC: TSX SCG 1161
  * for TSX 37-2* PLC: TSX SCP 114
  * for TSX 47, 67, 87, 107 PLC: TSX SCM 21*6
  * built-in UNI-TELWAY port for processor
    TSX P47 425
    TSX 37 2* ***

***Note:** This does not include all the possibilities available with the terminal port.*

9.3.2. Modbus architecture



The multiplexer NW-BM85-000 of MODICON consists of:

- 1 communication port with MODBUS PLUS (medium redundancy option), in order to communicate with the upper level.

- 4 communication ports with MODBUS, with RS 232 support, which allow adding an RS 232 /RS 485 adaptor to connect several LT6P relays.

9.4. Database structure (values refreshed every second)

Access	Data	Addresses
READ ONLY	**Last 5 trips** (50 signed integers of 16 bits)	0 49
	Trip cause counters (11 signed integers of 16 bits) Saved in E²PROM	50 60
	Motor maintenance (3 signed integers of 16 bits) Saved in E²PROM	61 64
	Measured values (11 signed integers of 16 bits) Thermal constants saved in E²PROM	65 75
	Front face settings (2 integers of 16 bits)	76 77
	Operating faults (coded on bits with 1 word of 16 bits)	78
	Status of the front face switches (coded on bits with 1 word of 16 bits)	79
	I/O status (coded on bits with 1 word of 16 bits)	80
	LT6 trip type (coded on bits with 1 word of 16 bits)	81
	Status of fleeting alarms (coded on bits with 1 word of 16 bits)	82
READ AND WRITE	**Motor and product commands** (coded on bits with 1 word of 16 bits)	83
	Protection threshold parameter setting (22 signed integers of 16 bits) Saved in E²PROM	84 109
	Activation of the protection Saved in E²PROM	110

Word	Bit	Name	Factory Settings	Unit	Values Min / Max	Operation	Comments
READ ONLY							
0		Trip cause			0 / 15	Trip cause code	
1		Th. state long const (Fe)		0.01θn	0 / 200	**Trip (N)**	
2		Th. state short const (Cu)		0.01θn	0 / 200		
3		Rms current phase 1		1% Ir	0 / 1600	**This record is also**	
4		Rms current phase 2		1% Ir	0 / 1600	**the "unsolicited data"**	
5		Rms current phase 3		1% Ir	0 / 1600	**sent to host**	
6		Unbalance current Id		1% Iav	0 / 100	**(see Section 9.2**	
7		Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999	**"Unsolicited Data")**	
8		Cos φ		0.01	-100 / 100		**Register**
9		Voltage		1%	68 / 120		**of the**
10		Trip cause			0 / 15	Trip cause code	**last**
11		Th. state long const (Fe)		0.01θn	0 / 200	**Trip (N - 1)**	**5 trips**
12		Th. state short const (Cu)		0.01θn	0 / 200		
13		Rms current phase 1		1% Ir	0 / 1600		
14		Rms current phase 2		1% Ir	0 / 1600		
15		Rms current phase 3		1% Ir	0 / 1600		
16		Unbalance current Id		1% Iav	0 / 100		
17		Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999		
18		Cos φ		0.01	-100 / 100		
19		Voltage		1%	68 / 120		
20		Trip cause			0 / 15	Trip cause code	
21		Th. state long const (Fe)		0.01θn	0 / 200	**Trip (N - 2)**	
22		Th. state short const (Cu)		0.01θn	0 / 200		
23		Rms current phase 1		1% Ir	0 / 1600		
24		Rms current phase 2		1% Ir	0 / 1600		
25		Rms current phase 3		1% Ir	0 / 1600		
26		Unbalance current Id		1% Iav	0 / 100		
27		Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999		
28		Cos φ		0.01	-100 / 100		
29		Voltage		1%	68 / 120		
30		Trip cause			0 / 15	Trip cause code	
31		Th. state long const (Fe)		0.01θn	0 / 200	**Trip (N - 3)**	
32		Th. state short const (Cu)		0.01θn	0 / 200		
33		Rms current phase 1		1% Ir	0 / 1600		
34		Rms current phase 2		1% Ir	0 / 1600		
35		Rms current phase 3		1% Ir	0 / 1600		
36		Unbalance current Id		1% Iav	0 / 100		
37		Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999		
38		Cos φ		0.01	-100 / 100		
39		Voltage		1%	68 / 120		
40		Trip cause			0 / 15	Trip cause code	
41		Th. state long const (Fe)		0.01θn	0 / 200	**Trip (N - 4)**	
42		Th. state short const (Cu)		0.01θn	0 / 200		
43		Rms current phase 1		1% Ir	0 / 1600		
44		Rms current phase 2		1% Ir	0 / 1600		
45		Rms current phase 3		1% Ir	0 / 1600		
46		Unbalance current Id		1% Iav	0 / 100		
47		Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999		
48		Cos φ		0.01	-100 / 100		
49		Voltage		1%	68 / 120		
50		Iron thermal trip		1	0 / 32767	E^2 = Also stored in E^2PROM	
51		Copper thermal trip		1	0 / 32767	E^2	
52		PTC thermistor		1	0 / 32767	E^2	
53		Phase unbalance/loss		1	0 / 32767	E^2	
54		Earth fault		1	0 / 32767	E^2	
55		Undercurrent		1	0 / 32767	E^2	**Trip cause**
56		Torque limitation		1	0 / 32767	E^2	**counters**
57		Prolonged starting		1	0 / 32767	E^2	
58		Direction of rotation		1	0 / 32767	E^2	
59		Cos φ		1	0 / 32767	E^2	
60		Test button		1	0 / 32767	E^2	

61	Number of starts		1	0 / 32767	E^2	
62	Motor operating time		1 hour	0 / 32767	E^2	**Motor**
63	N° channel A close ops		1	0 / 32767	E^2	**maintenance**
64	N° channel B close ops		1	0 / 32767	E^2	
65	Long therm const (FE)	50	0.01θn	0 / 200	E^2	**Actual**
66	Short therm const (CU)	50	0.01θn	0 / 200	E^2	**values**
67	Rms current phase 1		1% Ir	0 / 1600		
68	Rms current phase 2		1% Ir	0 / 1600		These values are
69	Rms current phase 3		1% Ir	0 / 1600		always calculated
70	Unbalance current Id		1% Ir	0 / 200		even if the
71	Value $I_{\Delta r}$ (Earth fault)		0.1 A	0 / 999		corresponding
72	Time bef. reset enabled		1 s	0 / 1000	Time calculated by the LT6	functions
73	Cos φ		0.01	- 100 / 100		are not enabled
74	Voltage		1%	0 / 200		
75	Fréquency		0.1 Hz	0 / 700		
76	"Ir" front face	20	1%	20 / 109	Combination of 2 switches	Initial value of the 3
77	"Classe" front face	5	5	5 / 30		front face switches
78, 0	Fault	0		0 / 1	1 = All product faults	**Fleeting states**
78, 1	Supply fault	0		0 / 1	1 = Supply fault	
78, 2	Short-circuit detection	0		0 / 1	1 = Short-circuit	These 16 bits are
78, 3	UNI-TELWAY fault	0		0 / 1	1 = UNI-TELWAY fault	set to 1 on fault
78, 4	JBus/Modbus fault	0		0 / 1	1 = Jbus/Modbus fault	detection. They
78, 5	Line ⇔ Local	0		0 / 1	1 = Change. discrete "Line/Local"	must be read to be
78, 6	Adj. line ⇔ Adj. local	0		0 / 1	1 = Change. Dip "adj. line/local"	reset to zero
78, 7	Watchdog fault	0		0 / 1	1 = Fault	
78, 8						
78, 9						
78, A						
78, B						
78, C						
78, D						
78, E						
78, F						
79, 0	Dip "Adress" (Parity)	0		0 / 1	1 = Even parity	
79, 1	Dip "Adress" (16)	0		0 / 1	1 = 16	
79, 2	Dip "Adress" (8)	0		0 / 1	1 = 8	
79, 3	Dip "Adress" (4)	0		0 / 1	1 = 4	**State of discrete**
79, 4	Dip "Adress" (2)	0		0 / 1	1 = 2	
79, 5	Dip "Adress" (1)	1		0 / 1	1 = 1	**inputs**
79, 6	Dip "UNI-TELWAY/Jbus"	1		0 / 1	1 = UNI-TELWAY	
79, 7	Dip "Reset auto/manu"	1		0 / 1	1 = Manual reset	**Front face**
79,	Dip "Adjust line/local"	0		0 / 1	0 = Local adjust	
79, 9	Reserved	0		0 / 1		
79, A	Reset	0		0 / 1	1 = "Reset" button activated	
79, B	Test	0		0 / 1	1 = "Test" button activated	
79, C						
79, D						
79, E						
79, F	Initial values	1		0 / 1	1 = Operation with initial values	(words 84 to 110)
80, 0	Start channel A	0		0 / 1		**State of discrete**
80, 1	Start channel B	0		0 / 1		
80, 2	Stop channels A and B	0		0 / 1		**inputs**
80, 3	Local-Line	0		0 / 1		
80, 4	Reset	0		0 / 1		
80, 5	Input C	0		0 / 1		
80, 6	Input D	0		0 / 1		
80, 7	Input E	0		0 / 1		
80, 8	Motor starting	0		0 / 1	1 = Starting cycle	**Motor**
80, 9	Motor running	0		0 / 1	1 = (I > 0.2 Ir)	**status**
80, A						
80, B	Outputs load shed	0		0 / 1	1 = Outputs at 0 as load shed	**State of discrete**
80, C	Channel A	0		0 / 1	1 = Contact channel A closed	**outputs**
80, D	Channel B	0		0 / 1	1 = Contact channel B closed	
80, E	Trip	0		0 / 1	1 = Product tripped	
80, F	Alarm	0		0 / 1	1 = Alarm	

81, 0	Iron thermal trip	0		0 / 1		
81, 1	Copper thermal trip	0		0 / 1	These bits are set to 1 by a	
81, 2	PTC thermistor	0		0 / 1	product trip and are reset	
81, 3	Phase unbalance/loss	0		0 / 1	to zero by a "Reset" which	
81, 4	Earth fault	0		0 / 1	may be automatic or	
81, 5	Undercurrent	0		0 / 1	manual	
81, 6	Torque limitation	0		0 / 1		
81, 7	Prolonged starting	0		0 / 1		**Trips**
81, 8	Direction of rotation	0		0 / 1		
81, 9	Cos φ	0		0 / 1		
81, A	Test button	0		0 / 1		
81, B				0 / 1		
81, C				0 / 1		
81, D				0 / 1	These bits are set to 1 by a	**Fault**
81, E	Measurement input fault	0		0 / 1	product fault and are reset	
81, F	PTC therm short-circuit	0		0 / 1	to zero by a "Reset"	
82, 0	Therm overload alarm	0		0 / 1		
82, 1	Phase unbalance/loss	0		0 / 1		
82, 2	Earth fault	0		0 / 1	These bits are at 1, if the	
82, 3	Undercurrent	0		0 / 1	corresponding thresholds are	
82, 4	Torque limitation	0		0 / 1	exceeded independently of time	**Alarms**
82, 5	Cos φ	0		0 / 1		
82, 6				0 / 1		
82, 7				0 / 1		
82, 8				0 / 1		
82, 9						
82, A						
82, B						
82, C						
82, D						
82, E						
82, F						

READ AND WRITE

83, 0	Start / Stop channel A	0		0 / 1	1 = Start ch. A ; 0 = Stop ch. A	**Motor control**
83, 1	Start / Stop channel B	0		0 / 1	1 = Start ch. B ; 0 = Stop ch. B	(4 bits ⇒
83, 2	Reset	0		0 / 1	1 = Reset ; reset by the LT6	(Reset on trip /
83, 3	Test	0		0 / 1	1 = Test ; reset by the LT6	fault)
83, 4						
83, 5						
83, 6						
83, 7						
83, 8						
83, 9						
83, A						
83, E						
83, C						
83, D	Reset trip counters	0		0 / 1	1 = Reset trip counters	**Product**
83, E	Reset Maint. counters	0		0 / 1	1 = Reset Motor maintenance	
83, F	Load initial values	0		0 / 1	1 = Operation with initial values	**control**
84	Value of Ir (% rating)	20	1%	20 / 109	E² = Also stored in E²PROM	
85	Value of Class	5	5	5 / 30	E² **Thermal overload**	
86	Overload alarm thresh.	100	1% θn	0 / 100	E²	
87	Id threshold (% of Iav)	30	1%	10 / 30	E²	
88	Tripping time on starting	7	0.1 s	0 / 100	E² **Phase unbalance**	
89	Tripping time in operat'n	50	0.1 s	0 / 100	E²	
90	$I_{\Delta r}$ threshold	300	0.1 A	3 / 300	E²	
91	Tripping time	50	0.1 s	0 / 50	E² **Earth fault**	
92	I_{sd} threshold (% of Ir)	150	1%	100 / 500	E²	
93	Starting time	100	0.1 s	0 / 300	E² **Prolonged starting**	
94	I_v threshold (% de Ir)	30	1%	30 / 90	E²	
95	Tripping time	100	0.1 s	0 / 300	E² **Undercurrent**	
96	I_{LC} threshold (% de Ir)	200	1%	150 / 800	E²	
97	Tripping time	100	0.1 s	0 / 300	E² **Torque limitation**	**Parameters**
98	Cos φ threshold	10	0.01	- 100 / 100	E²	
99	Tripping time	100	0.1 s	0 / 100	E² **Cos φ**	**Transmitted by**

100	Level of voltage threshold	70	1% Un	68 / 120	E²	
101	Time before shedding	1000	10 s	0 / 10000	E²	**Communication**
102	Level of reconnection	90	1% Un	68 / 120	E²	
103	Time before reconnection	1000	10 s	0 / 10000	E² **Voltage threshold**	**line**
104	Time before reset enab.	0	1 s	0 / 1000	E²	
105	θ°C Fe bef. reset enab.	100	1% θn	40 / 100	E² **Reset**	
106	Unsolicited data	- 1	1	- 1 / 32	E²	
107	Reserved					
108	Value of motor In	0		0 / 32767	E² These 2 words are for data	Used for power
109	Value of motor Un	0		0 / 32767	E² entered by the user	calculation
110, 0	Thermal overload	1		0 / 1	E² 1 = Trip / Thermal overload	
110, 1	PTC thermistor	1		0 / 1	E² 1 = Trip / PTC thermistor	
110, 2	Phase unbalance/loss	1		0 / 1	E² 1 = Trip / Phase unbalance/loss	
110, 3	Earth fault	1		0 / 1	E² 1 = Trip / Earth fault	
110, 4	Undercurrent	0		0 / 1	E² 1 = Trip / Undercurrent	
110, 5	Torque limitation	0		0 / 1	E² 1 = Trip / Prolonged starting	
110, 6	Prolonged starting	0		0 / 1	E² 1 = Trip / Limit. couple	
110, 7	Direction of rotation	0		0 / 1	E² 1 = Trip / Direction of rotation	
110, 8	Cos φ	0		0 / 1	E² 1 = Trip / Cos φ	
110, 9	Load shedding	0		0 / 1	E² 1 = Load shedding active	
11 0, A	Reverser	1		0 / 1	E² 1 = Reverser control	Only one of these
110, B	Independent	0		0 / 1	E² 1 = A&B independent control	3 bits at any
110, C	2-step	0		0 / 1	E² 1 = 2-step starting control	one time
110, D	Front face Test button	1		0 / 1	E² 0 = Test button active	
110, E	Front face Reset button	1		0 / 1	E² 0 = Reset button active	
110, F	Sefl-cooled/Force-cooled	1		0 / 1	E² 1 = Self-cooled	

NOTE: The LT6 does not have a clock to indicate the time of the fault. Using a system clock avoids time differences between the various LT6 relays.

Configuration requirements:

- Configuration software kit LA9P620 provides an interface via a personal computer using Mobus protocol.
- Minimum requirements:
  IBM-compatible 386SX with Windows 3.1 or Windows 95
- LA9P620 Kit includes:
  3-1/2" diskette
  Reversible 2-meter long cable with RS 232 connections

NOTE: The DIP switch on the front face of the LT6 must be set for Jbus/Modbus connections.

Software installation:

Insert Distribution Disk in Diskette Drive A:
Start Windows if not already running

(From Windows Program Manager:)
Click on. . . . . FILE
Click on. . . . . RUN
Click on. . . . . BROWSE
Select A:
Click on. . . . . WINSTALL.EXE
Click. . . . . OK
Click. . . . . OK

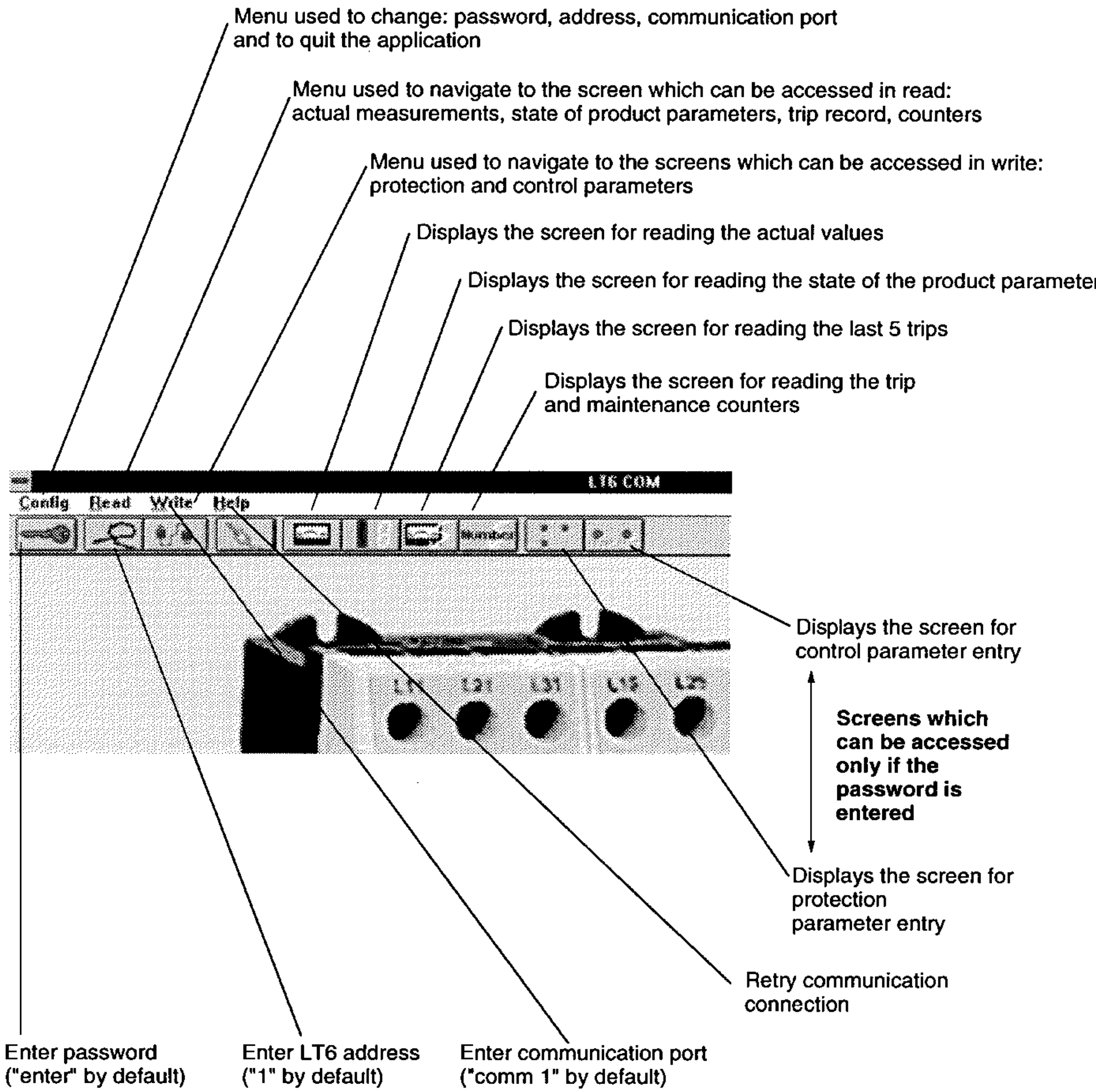
Follow the installation program prompts.

After installation, ensure the working directory is correct by (From the Windows Program Manager):
Highlight the LT6COM icon in Telemecanique Group
Click on. . . . . FILE
Click on. . . . . PROPERTIES

Edit the 'Working Directory' entry to read C:\LT6COM if it is not already entered.

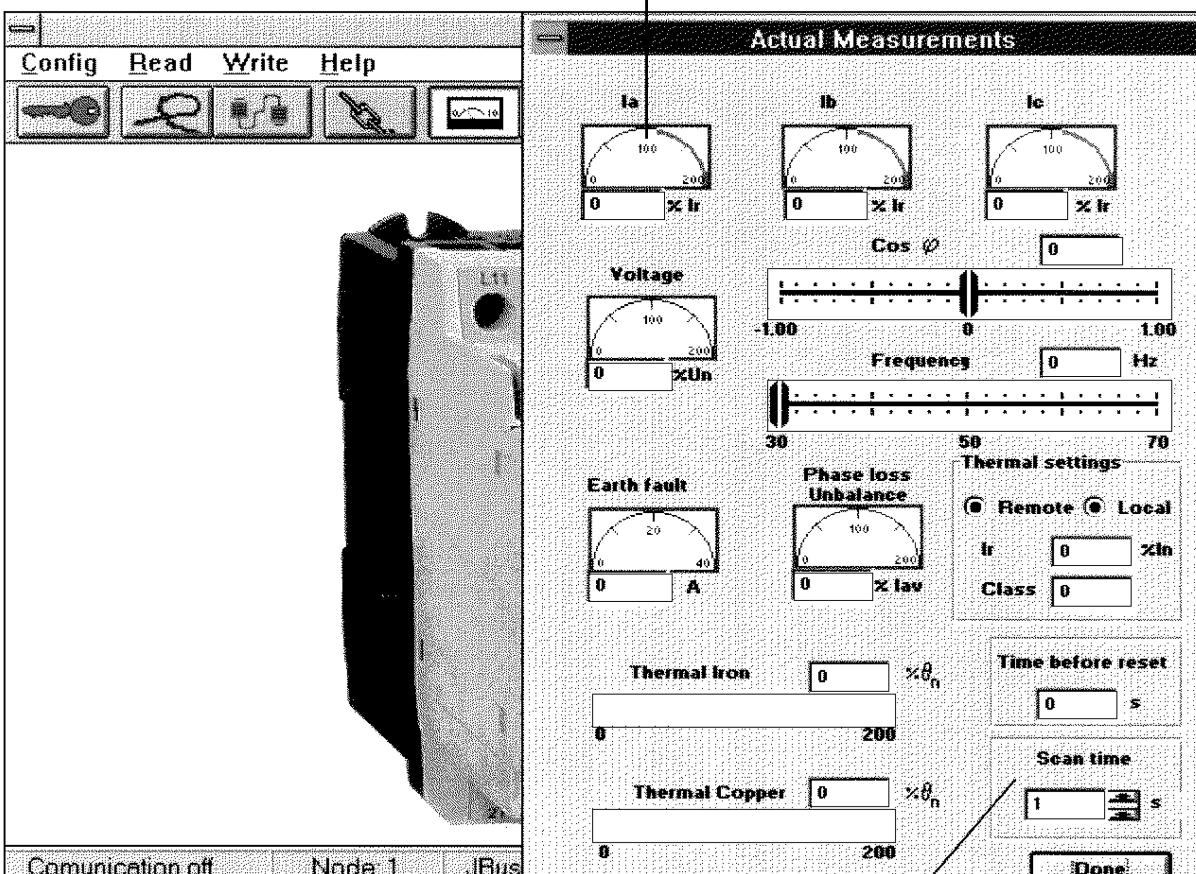
If you are using another Windows 'Shell' program, ensure that it is capable of changing directories to the working directory prior to launching LT6COM. Check with your information systems staff if you are not sure.

Screen descriptions



Actual values display

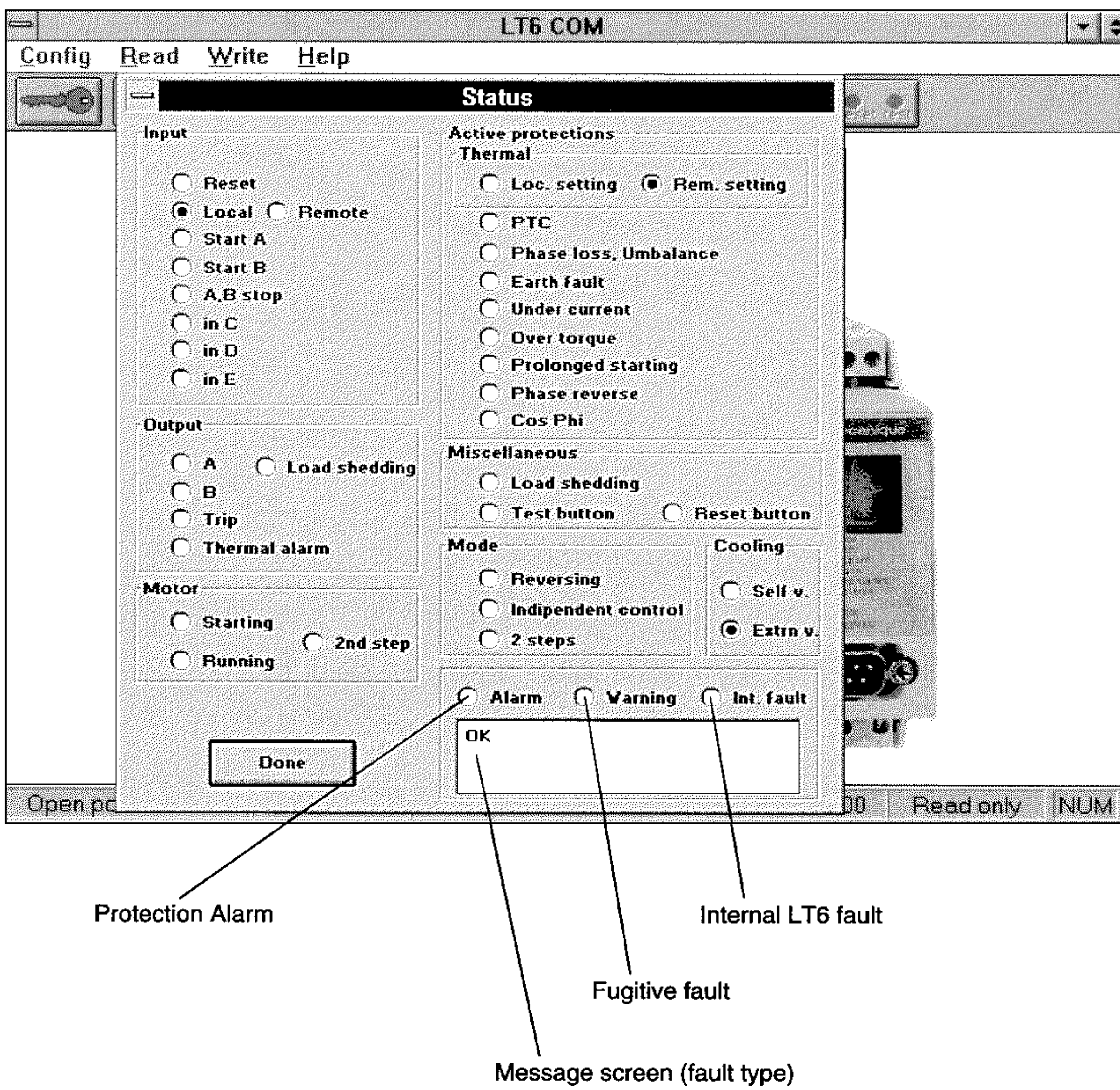
Value displayed is precentage of motor FLA versus maximum current rating of the LT6 input power terminals used for phases A-B-C



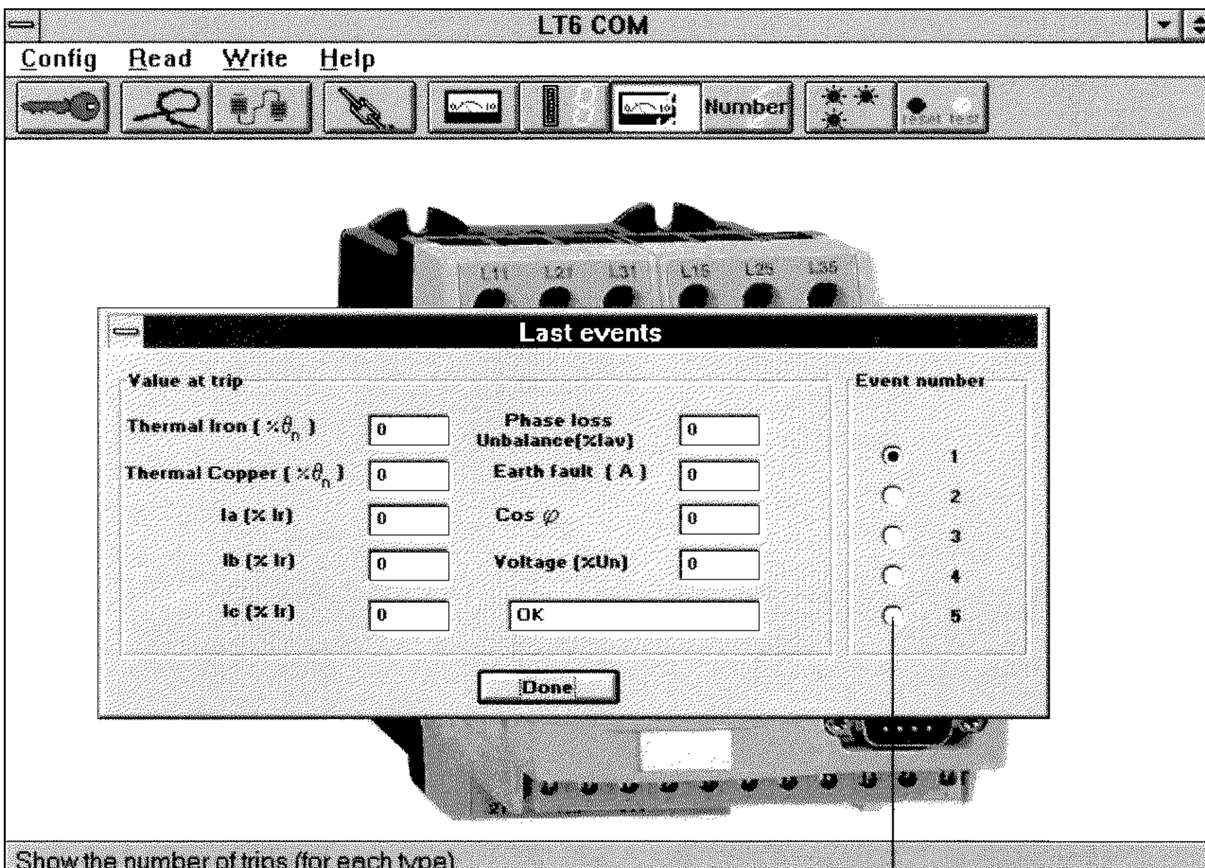
Scan time of the screen

Close window

Product status display



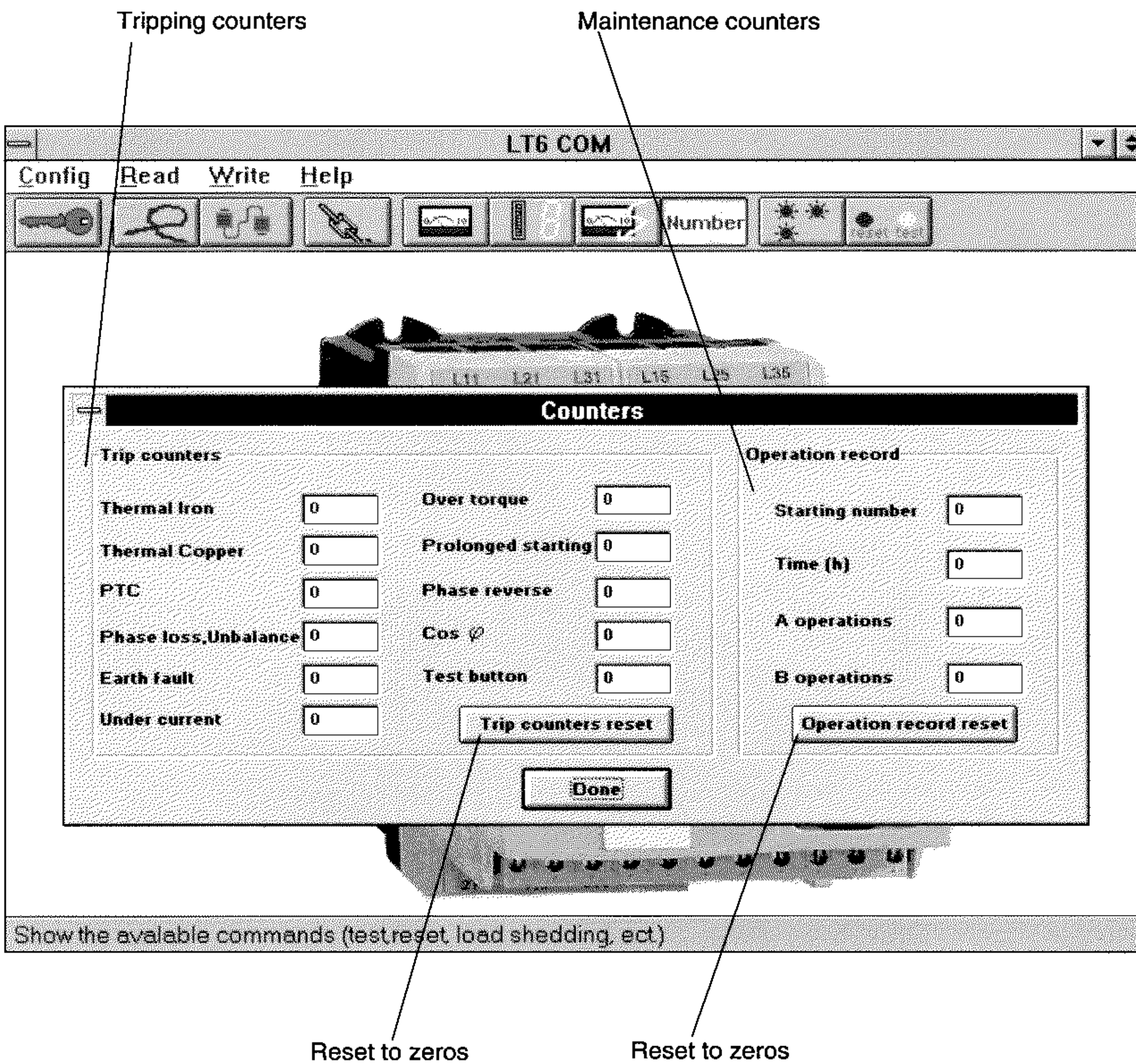
Display the 5 last trips



Event 1 = Last fault
Events 2 to 5 = Previous faults

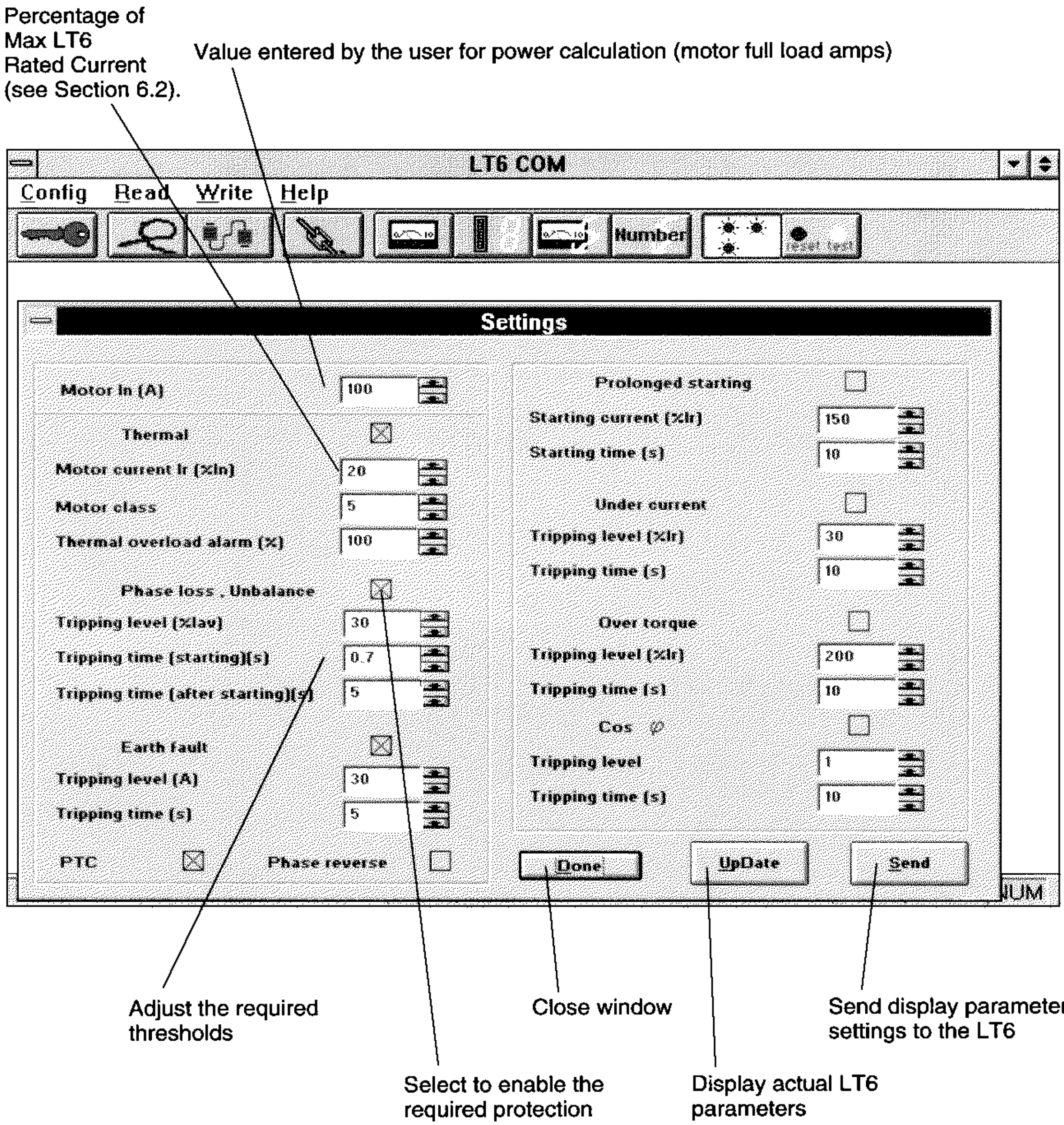
Counters display

Quantity of faults and operations since last counter reset.



Protection parameter setting

Set motor and protection parameters and enable/disable monitoring protection features.



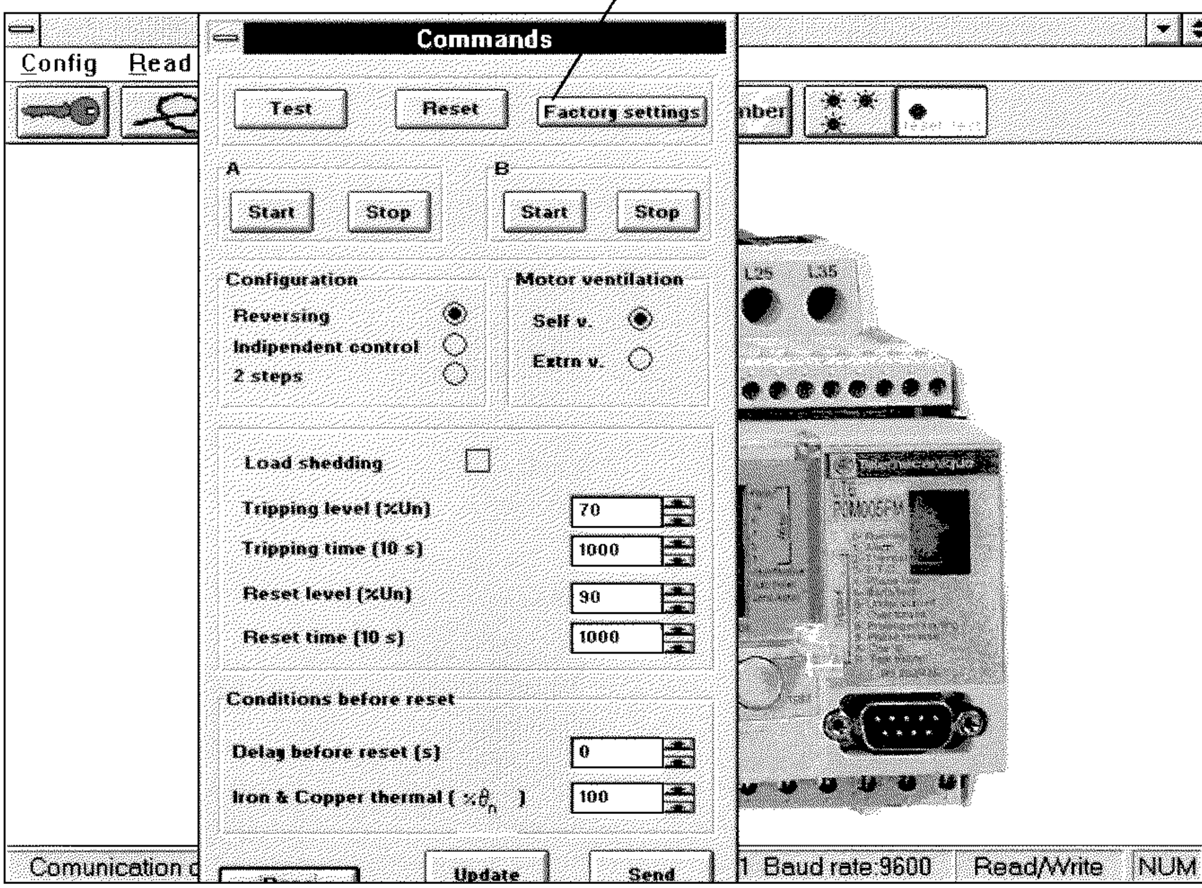
Do not forget to click "Send" to change the configuration of the parameters in the LT6.

Note: "Send" function is disabled when motor is running.

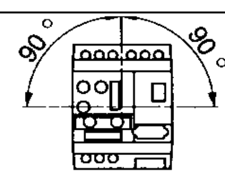
Commands setting

Motor Control Screen

Default all parameters to factory settings (see Section 6.1)



Environment

Conforming to standards			IEC 947-4-1, IEC 34-11, IEC 755, VDE 0106, VDE 0660.
European Community Directives			CE Meets the essential requirements of the Low Voltage equipment (LV) & Electromagnetic Compatibility (EMC).
Approvals			UL 508, CSA, PTB
Protective treatment			"TH" (tropical finish)
Degree of protection	Conforms to IEC 947-1		IP 20 (1)
Pollution degree	Conforms to IEC 664		3
Shock resistance	Conforms to IEC 68-2-27		15 gn, 11 milliseconds
Vibration resistance	Conforms to IEC 68-2-6		2 gn (3 to 100 Hz)
Ambient air temperature around the device	Storage	°C °F	- 35 to + 85 - 31 to +185
	Operation	°C °F	- 20 to + 70 - 4 to + 158
Flame resistance	Conforms to UL 94		V0
Maximum operating altitude		m ft	2000 6562
Operating position	In relation to normal vertical mounting plane		
Resistance to electrostatic discharge	Conforms to IEC 1000-4-2 level 3	kV	8
Resistance to electromagnetic interference	Conforming to IEC 1000-4-3 level 3	V/m	10
Resistance to fast transient currents	Conforms to IEC 1000-4-4 level 4	kV	2
Resistance to conducted radio-frequency disturbances			Conforms to IEC 1000-4-6 level 3
Rated undissipated pulse withstand (U imp)	Conforms to IEC 947-1	kV	6
Rated dissipated pulse withstand			Conforms to IEC 1000-4-5 level 3
Resistance to low frequency disturbances, supply harmonics			Conforms to IEC 947-2 Appendix F Clause F4.1
Resistance to micro-breaks			Conforms to IEC 1000-4-11

(1) Only applicable when power cabling to relay exceeds the following sizes : 1.5 mm² (16 AWG) fitted with cable end or 2.5 mm² (14 AWG) not fitted with cable end.

Power circuit characteristics – Terminals L11, L21, L31, L15, L25, L35, 2T1, 4T2, 6T3

Relay type			**LT6-P0M005FM**	**LT6-P0M025FM**
Rated insulation voltage (Ui)	Conforms to IEC 947-1	**V**	690 VAC	690 VAC
Motor voltage range		**V**	110 to 600 VAC	110 to 600 VAC
Operating frequency		**Hz**	50/60 (1)	50/60 (1)
Operational current range		**A**	0.2 to 5 (2)	5 to 25
Cabling Solid cable	1 or 2 conductors	**mm²** **AWG**	1.5 to 6 16 to 10	
Stranded cable without cable end	1 or 2 conductors	**mm²** **AWG**	1.5 to 6 16 to 10	
Stranded cable with cable end	1 or 2 conductors	**mm²** **AWG**	1.5 to 4 16 to 12	
Terminal tightening torque		**N•m** **lb-in**	1.7 15	
Associated protection By circuit breaker			Select in accordance with National Electric Code and Local Codes	
By fuses	≤ 1 A 1 to 5 A > 5 A		RK5-4 A max. RK5- 20 A max. Max. 400% of motor FLA	Max. 400% of motor FLA

Control circuit supply characteristics – Terminals A1, A2

Rated insulation voltage (Ui)	Conforms to IEC 947-1	**V**	380 VAC
Operating voltage		**V**	90 to 276 VDC 90 to 276 VAC 50/60 Hz
Cabling Solid cable	Plug-in connector 1 or 2 conductors	**mm²** **AWG**	0.5 to 1 20 to 18
Stranded cable without cable end	1 or 2 conductors	**mm²** **AWG**	0.5 to 1 20 to 18
Stranded cable with cable end	1 conductor	**mm²** **AWG**	0.5 to 1 20 to 18
	2 conductors	**mm²** **AWG**	0.5 to 0.75 20 to 18
Terminal tightening torque		**N•m** **lb-in**	0.7 6.5

(1) For use with 110 to 690 V - 50/60 Hz AC motors only. Not approved for use with DC motors or variable speed drives.
(2) For motors > 25 A, use LT6P0M005FM with customer provided external current transformers with 1 A or 5 A secondary outputs.

11. Characteristics

Discrete input characteristics – Terminals I1, I2, I3, I4, I5, I6, I7, I8, C1, C2 (see "Control Circuit Supply Characteristics" for cabling sizes and terminal tightening torque)

Rated insulation voltage (Ui)	Conforms to IEC 947-1	V	250 VAC
Operational voltage range		V	90 to 150 VDC 90 to 276 VAC- 50/60 Hz
Current consumption	Minimum transient value	mA	≥ 1 (changing from 0 state to 1 state in t ≥ 4 ms)
Input impedance		kΩ	56

Discrete output characteristics – Terminals 95, 96, 01, 02 (see "Control Circuit Supply Characteristics" for cabling sizes and terminal tightening torque)

Rated insulation voltage (Ui)	Conforms to IEC 947-1	V	380 VAC
Type of output	Relay		1 N.O. per channel
Associated fuse protection	Conforms to IEC 947-5	A	RK5 – 6 A max.
AC loads Rated voltage		V	250 VAC
Permissible power for category DC-15 Associated with contactor		VA	500 (Ie = 0.5 A, Ue = 250 VAC, Ith = 5 A, cos φ = 0.4 for 100,000 operations) **LC1-K, LC2-K, LC7-K, LC8-K** **LC1-D09 to D95, LC1-F115 to F150**
DC loads Rated voltage		V	30 VDC
Permissible power for category DC-15 Associated with contactor		VA	50 (Ie = 0.5 A, Ue = 30 VDC, Ith = 5 A, L/R ≤ 25 ms for 100,000 operations) **LP1-K, LP2-K, LP1-D09 and D12** **LP1-D18 to D32 (with LA4-DC1U or DC2U)** **LP1-D40 to D80 (with LA4-DC3U)**

Signalling output characteristics – Terminals 97, 98, 93, 94 (see "Control Circuit Supply Characteristics" for cabling sizes and terminal tightening torque)

Rated insulation voltage (Ui)	Conforms to IEC 947-1	**V**	380 VAC
Type of output	Relay		1 N.O. per channel
Associated fuse protection	Conforms to IEC 947-5	**A**	RK5 - 4 A max.
Current limit	At U = 5 V	**mA**	10
AC loads Rated voltage		**V**	250 VAC
Permissible power for category AC-15 Associated with contactor		**W**	250 (Ie = 0.2 A, Ue = 250 VAC, Ith = 2 A, 300,000 operations for resistive load) **LC1-K, LC2-K, LC7-K, LC8-K with suppressor block LA4-KE**
DC loads Rated voltage		**V**	30 VDC
Permissible power for category DC-15 Associated with contactor		**W**	50 (Ie = 0.2 A, Ue = 30 VDC, Ith = 2 A, 300,000 operations for resistive load) **LP1-K, LP2-K with suppressor block LA4-KC**

External power current transformer characteristics – (Customer provided. Must have 1 A or 5 A secondary output)

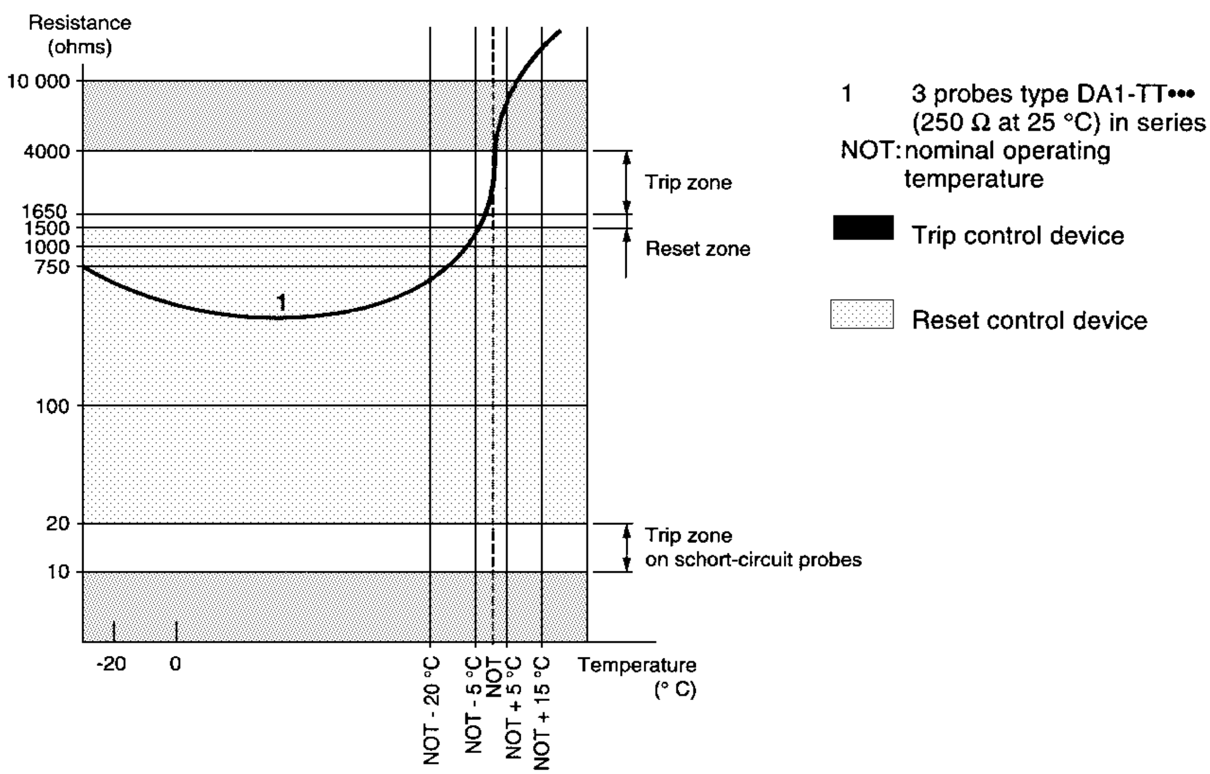
Conforming to standards			IEC 185, IEC 71
Accuracy class			Classe 5P
Accuracy limit factor			15

PTC Thermistor Probes			DA1-TT•••

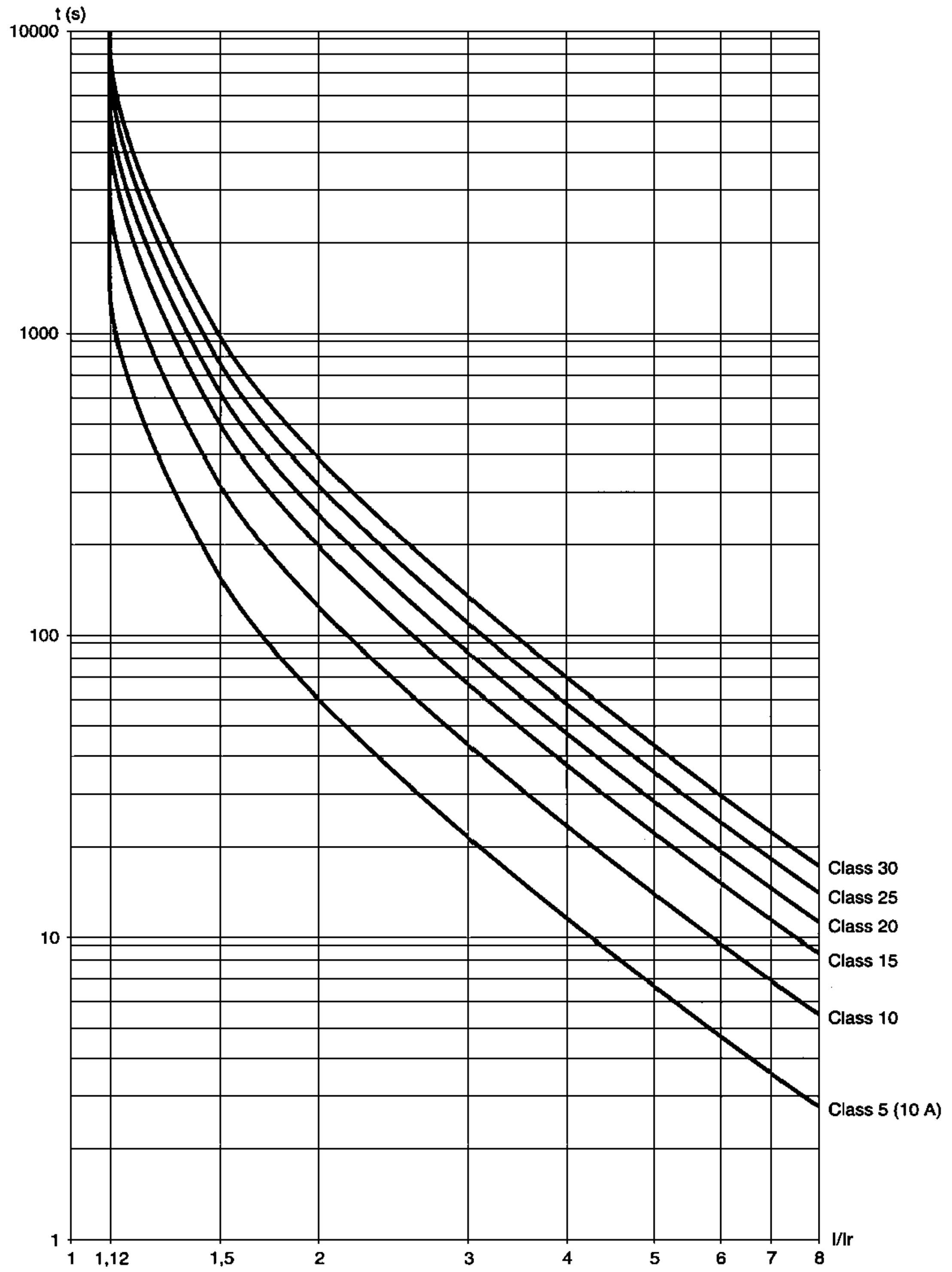
Probe characteristics– Terminals T1, T2 (see "Control Circuit Supply Characteristics" for Terminal Tightening Data)

Conforming to standards			IEC 34-11 mark A
Resistance	At 25 °C	Ω	3 x 250 in series
Rated operational voltage (Ue)	Per probe	**V**	2.5 VDC max.
Rated insulation voltage (Ui)		**kV**	2.5
Insulation			Reinforced
Cable lengths	Between probes	**mm** **in**	250 10
	Between probe and motor terminal block	**m** **ft**	**1** 3

Guaranteed operating zones : examples with 3 probes type DA1-TT••• (250 Ω at 25 °C) connected in series, conforming to IEC 34-11, mark A.



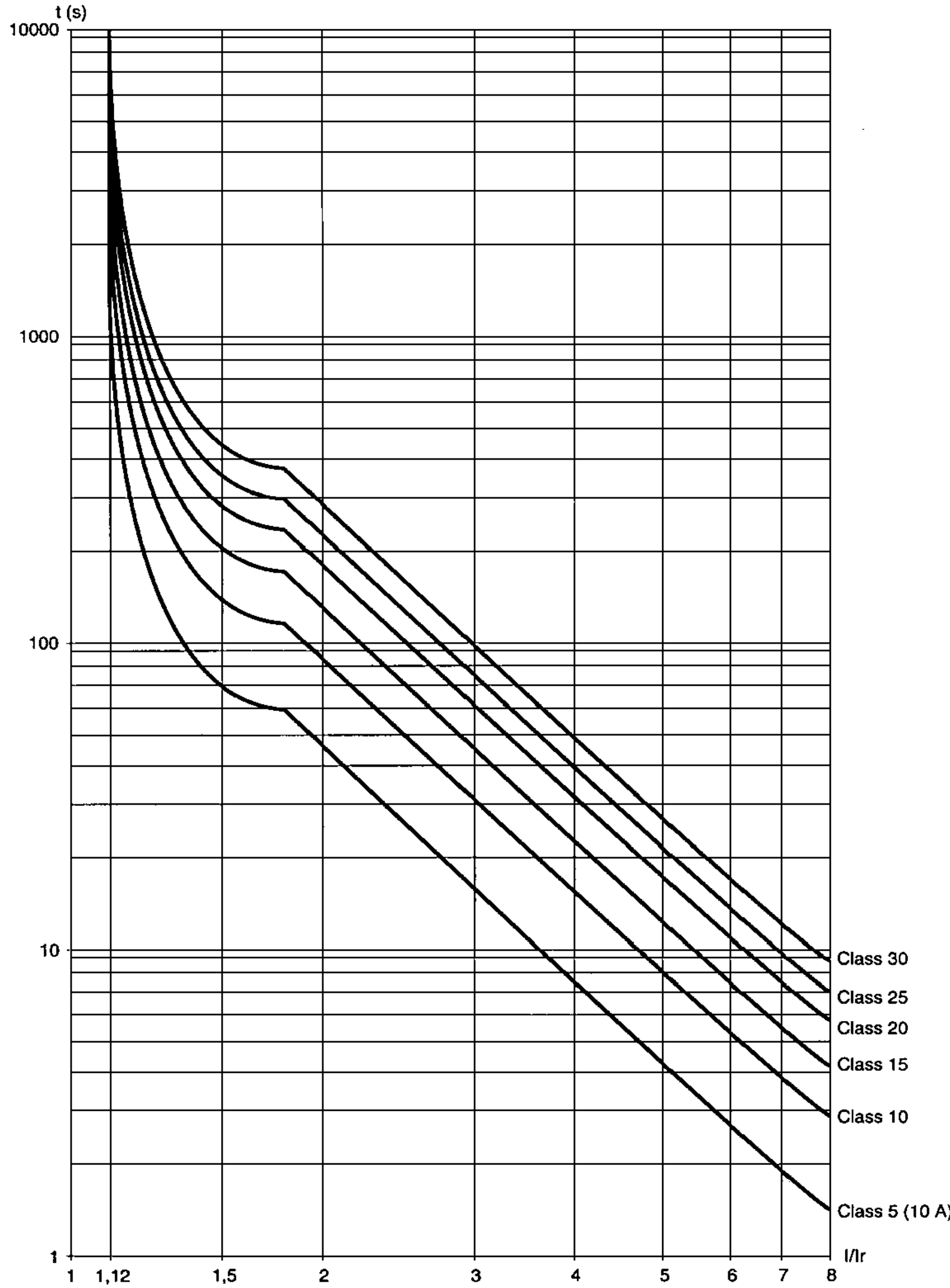
Cold state curves (1) – (See Section 6.2 for additional information)



(1) Tripping time accuracy : ± 8 % to 7.2 x I/Ir.

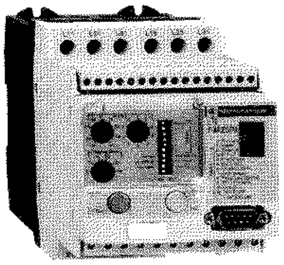
12. Tripping curves

Hot state curves (1) – (See Section 6.2 for additional information)



(1) Tripping time accuracy : ± 8 % to 7.2 x I/Ir.

3-pole multi-function protection relays



LT6-P0M005FM

Operational current A	Reference	Weight kg/lbs
0.2 to 1	**LT6-P0M005FM**	1.030/2.3
1 to 5	**LT6-P0M005FM**	1.030/2.3
5 to 25	**LT6-P0M025FM**	1.030/2.3

For AC motor FLC > 25 A, use LT6P0M005FM with customer-provided external current transformers with 1 A or 5 A secondary outputs.

Configuration software

Description	For use with	Reference	Weight kg/lbs
Kit comprising : - 3" 1/2 diskette, - 2 meter RS232 cable	All ratings of relay PC minimum req: 386SX & Windows 3.1	**LA9-P620**	0.550/1.2
User's Manual		**9110IM9701**	

Earth fault toroids

Products marketed under the Merlin Gerin brandname; to order, please refer to Merlin Gerin "Low voltage distribution catalog."

Sensitivity	Internal Diameter mm	Type	Weight kg/lbs
0.3 to 30 A	30	**TA30**	0.120/0.26
	50	**PA50**	0.200/0.44
	80	**IA80**	0.420/0.92
	120	**MA120**	0.530/1.17
	200	**SA200**	1.320/2.90
	300	**GA300**	2.230/4.91
	46	**POA**	1.300/2.86
	110	**GOA**	3.200/7.05

Note: Merlin Gerin earth fault toroids may be replaced with GFCT with 1000:1 ratio.

DA1-TT•••

PTC thermistor probes

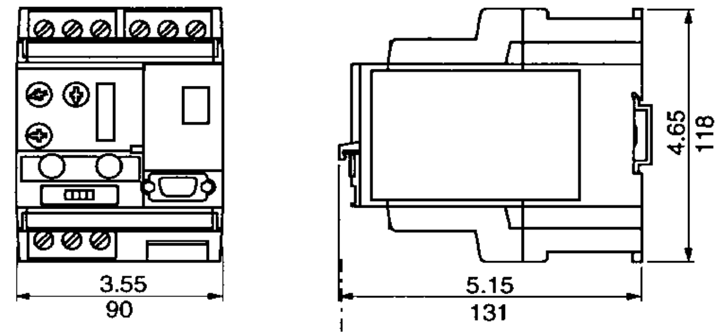
Description	Nominal operating temperature (NOT)	Sold in lots of	Unit reference	Weight
	° C			kg/lbs
Triple probes	90	10	**DA1-TT090**	0.010/0.35
	110	10	**DA1-TT110**	0.010/0.35
	120	10	**DA1-TT120**	0.010/0.35
	130	10	**DA1-TT130**	0.010/0.35
	140	10	**DA1-TT140**	0.010/0.35
	150	10	**DA1-TT150**	0.010/0.35
	160	10	**DA1-TT160**	0.010/0.35
	170	10	**DA1-TT170**	0.010/0.35

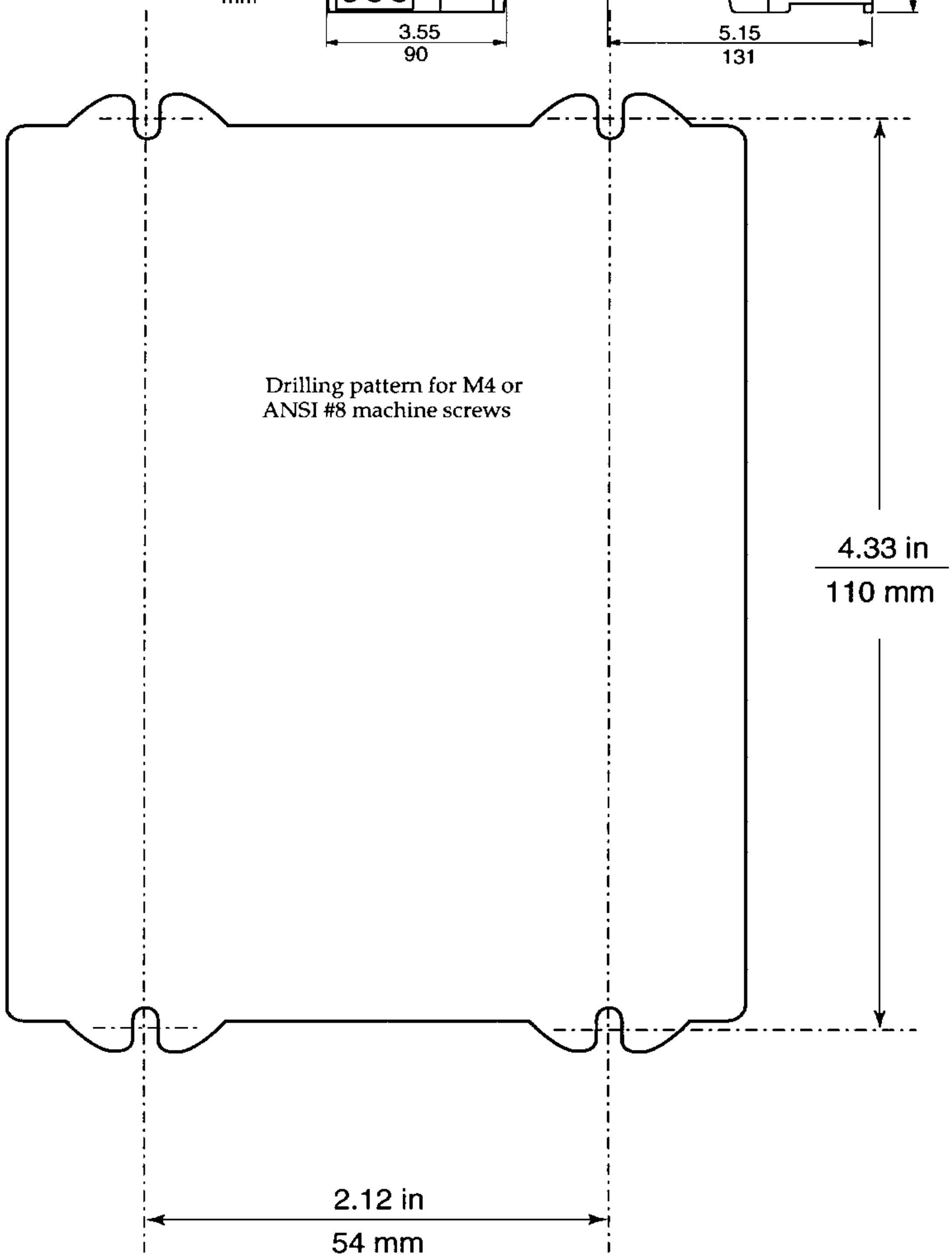
(1) When ordering, complete the reference with the number or letter required.

14. Dimensions, mounting

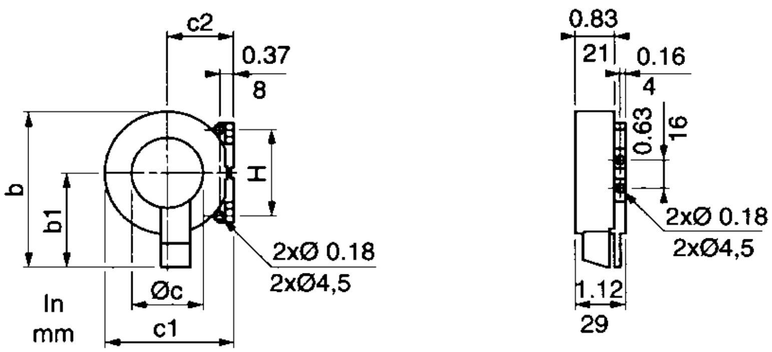
Protection relays LT6-P
LT6-P0M•••FM
on 35 mm " mounting rail

In / mm





Earth fault toroids TA30, PA50

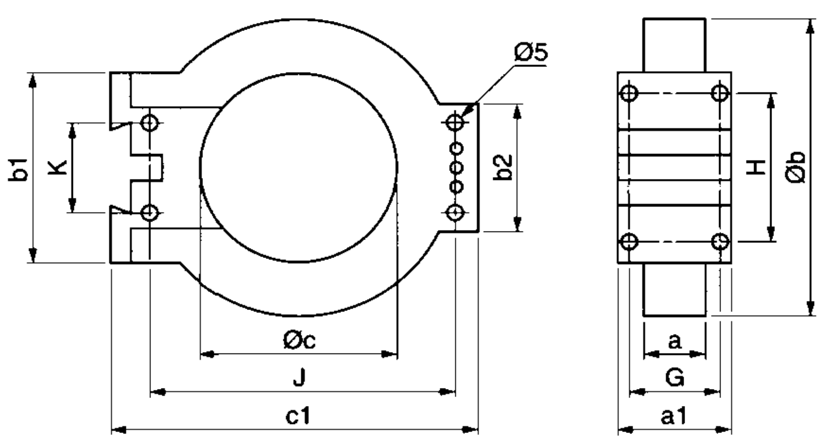


Dimensions in millimeters (1)

Type	b	b1	Øc	c1	c2	H
TA30	83	53	30	60	31	50
PA50	109	66	50	87	45	60

(1) 25.4 mm = 1 inch

Earth fault toroids IA80, MA120, SA200

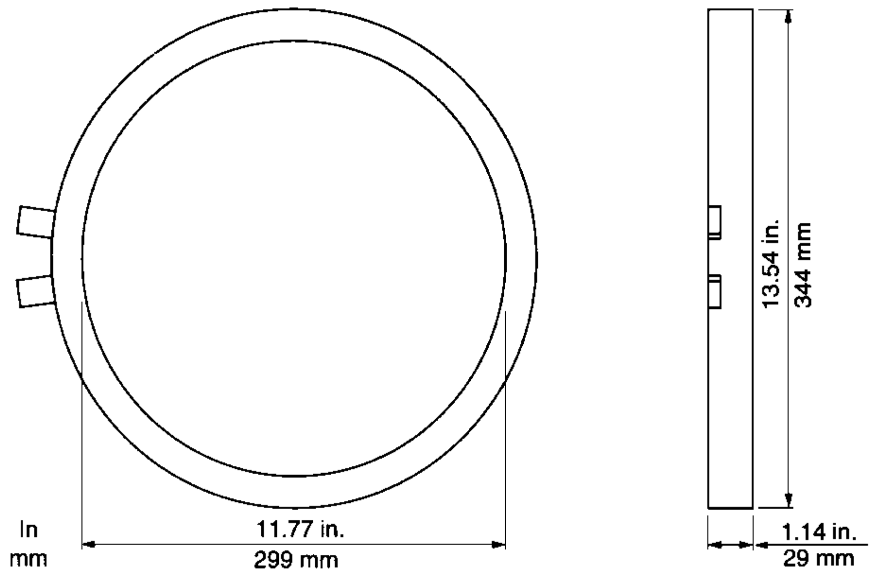


Dimensions in millimeters (1)

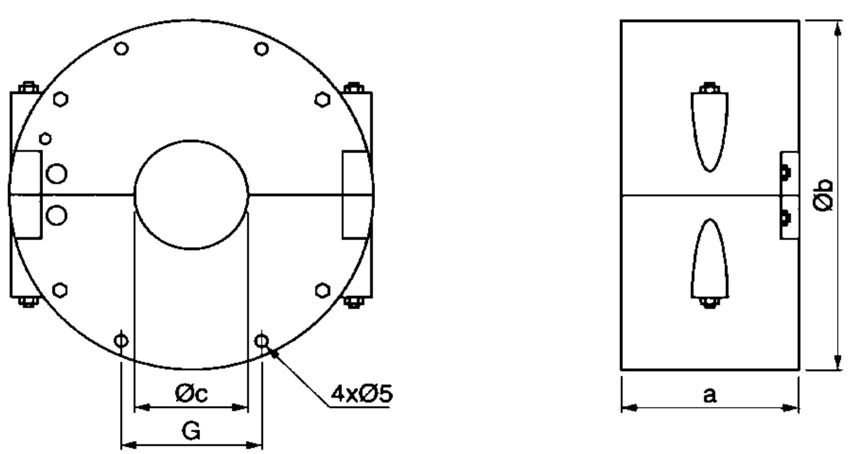
Type	a	a1	Øb	b1	b2	Øc	c1	G	H	J	K
IA80	26,5	44	122	80	55	80	150	35	65	126	40
MA120	26,5	44	164	80	55	120	190	35	65	166	40
SA200	29	46	256	120	90	196	274	37	104	254	60

(1) 25.4 mm = 1 inch

GA300



POA, GOA



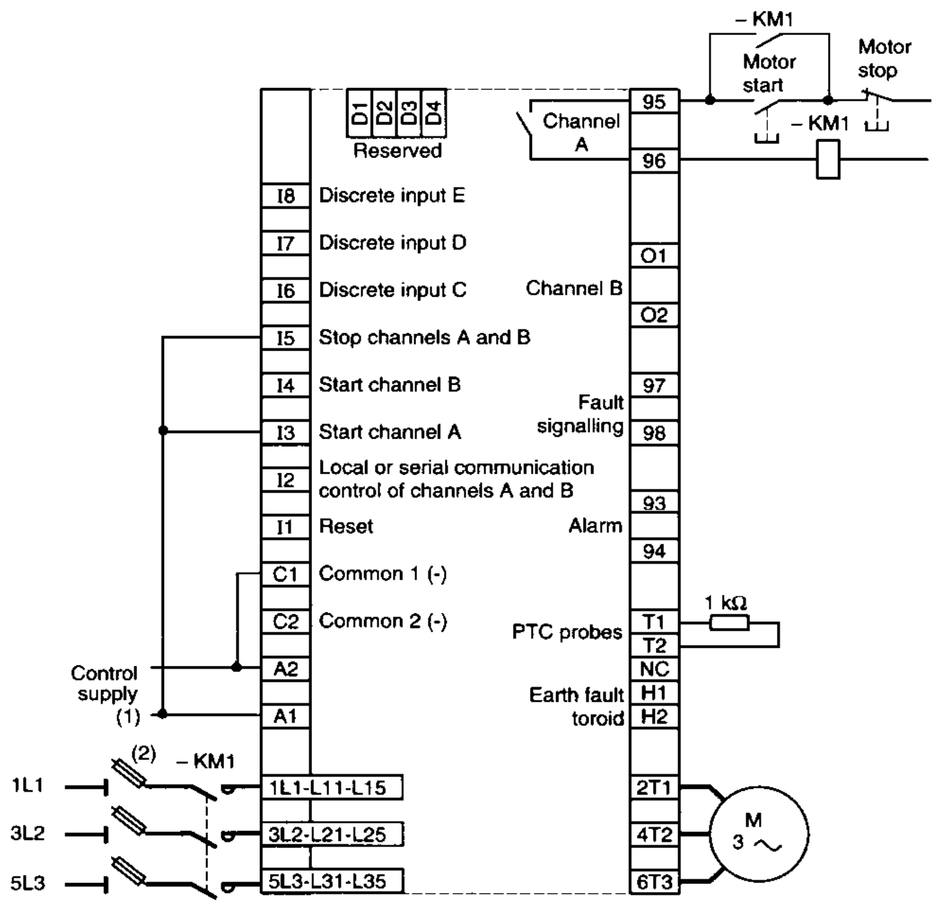
Dimensions in millimeters (1)

Type	a	Øb	Øc	G
POA	72	148	46	57
GOA	78	224	110	76

(1) 25.4 mm = 1 inch

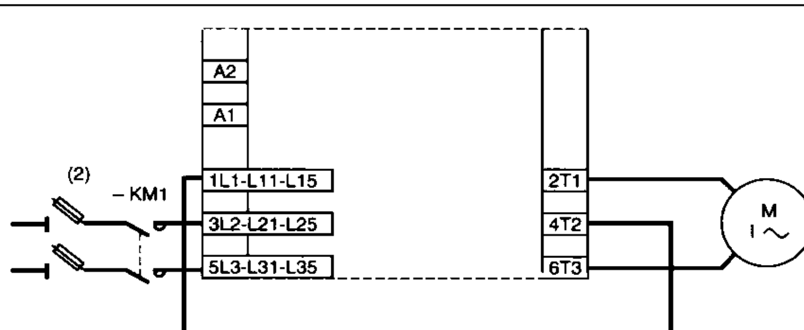
Motor control: Full voltage non-reversing starting (channels A and B set for reversing or independent control)

Control from front face of relay



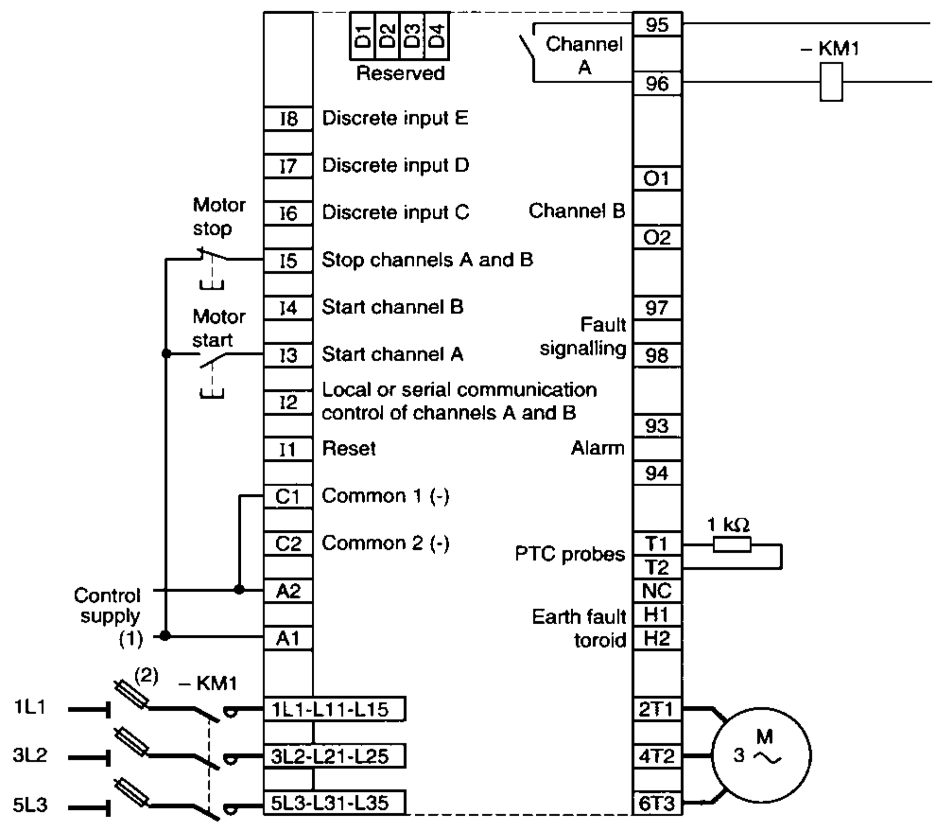
(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.

Power Terminal Connections For Single-Phase Motor Applications



Motor control : Full voltage non-reversing starting (channels A and B set for reversing or independent control)

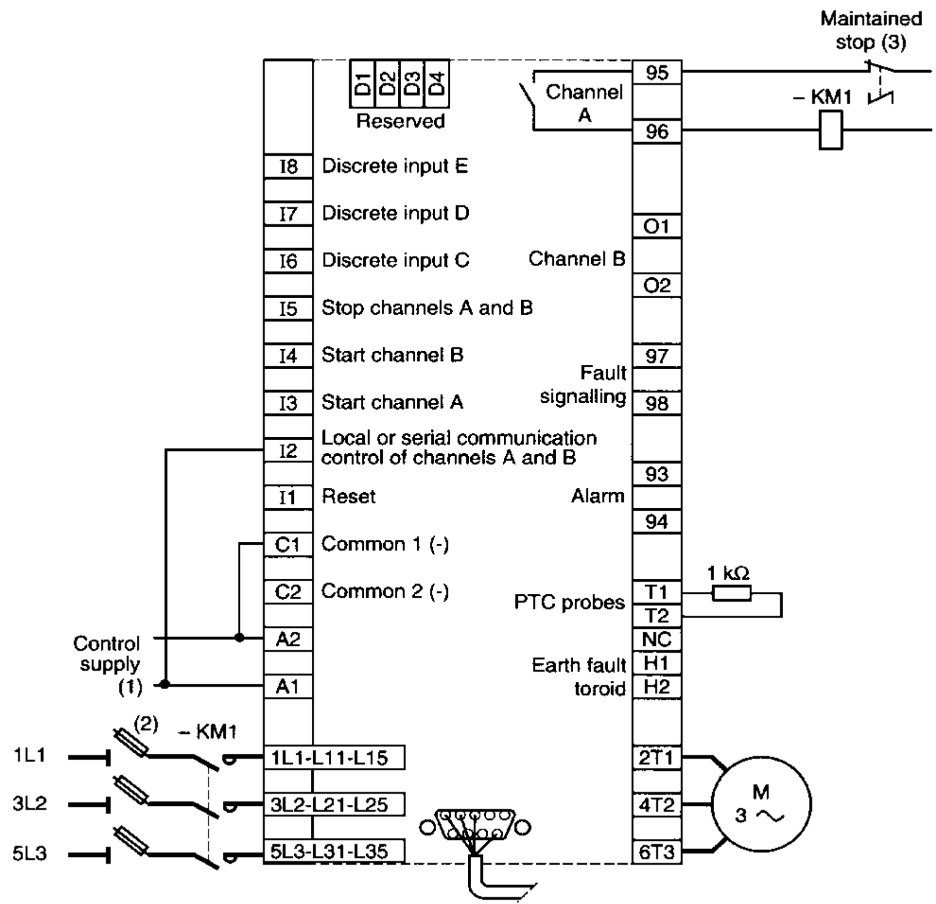
Control via discrete inputs of relay



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.

Motor control: Full voltage non-reversing starting (channels A and B set for reversing or independent control)

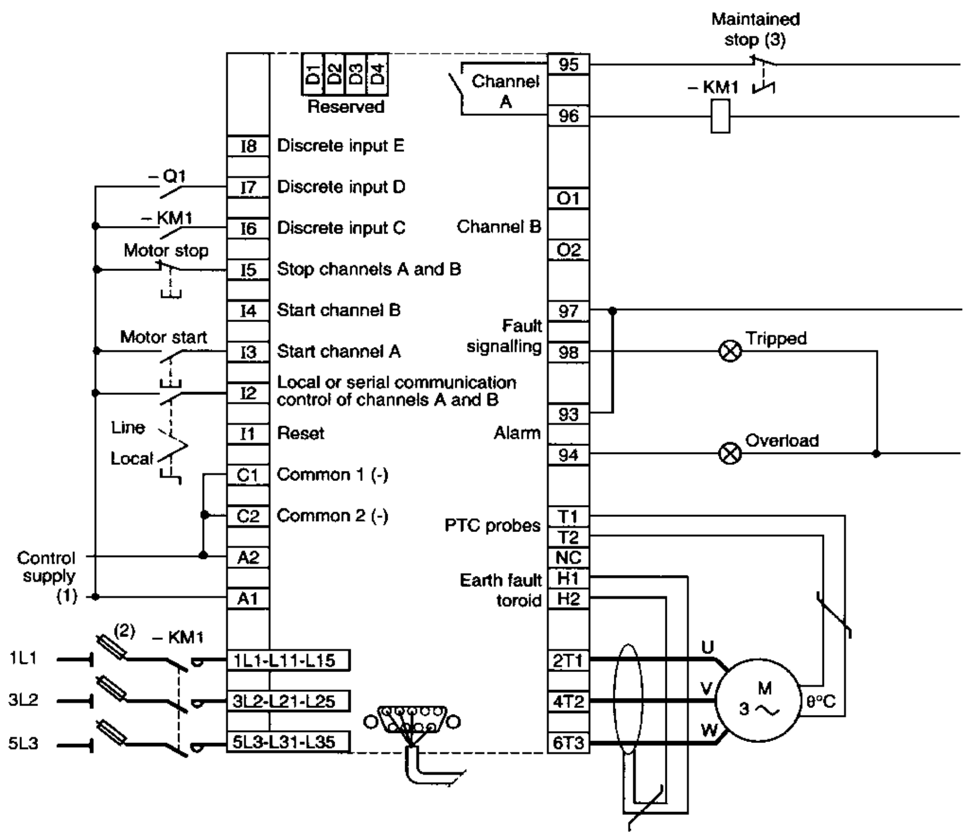
Control via serial link communication



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

Motor control: Full voltage non-reversing starting

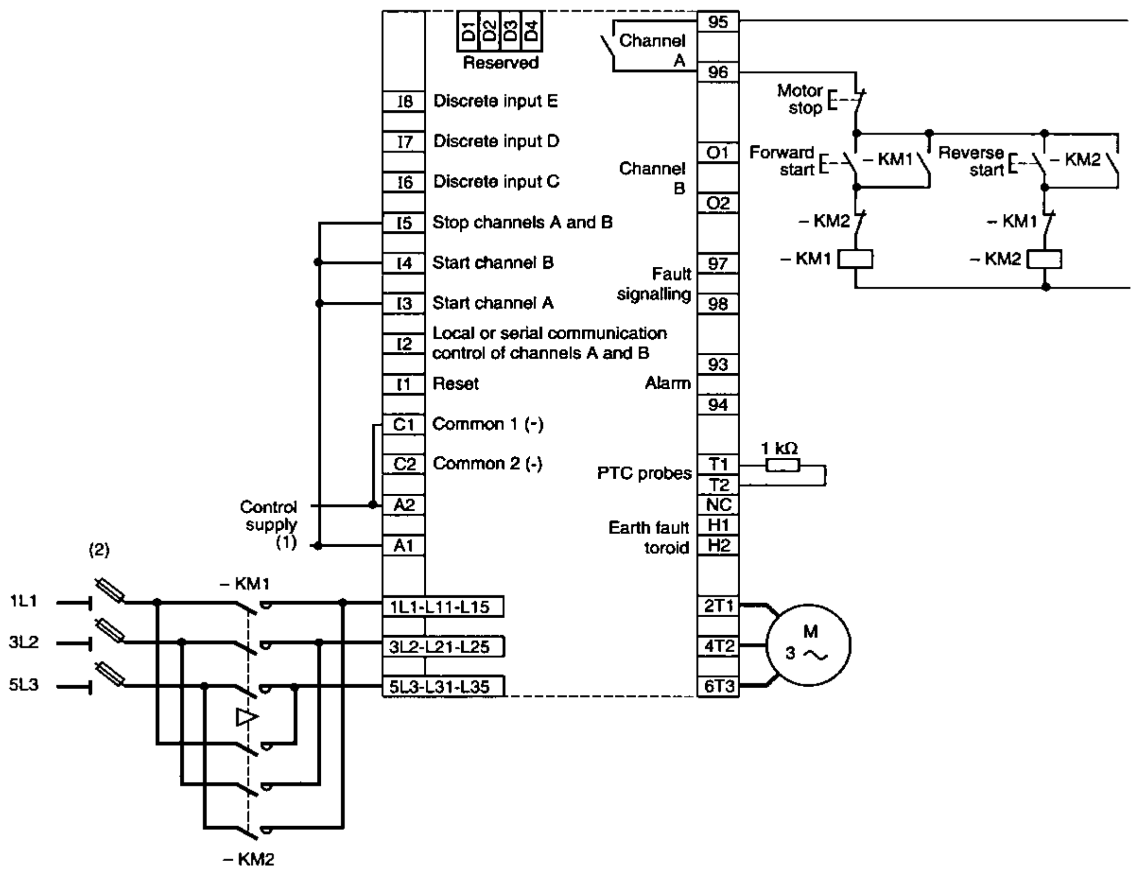
Control via serial link communication with signalling, earth fault toroid, PTC probes, state of power components.
Channels A and B set for reversing or independent control.
Possible to control the motor via discrete input ("local" position) or by serial link communication.



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

Motor control: Full-voltage reversing starting

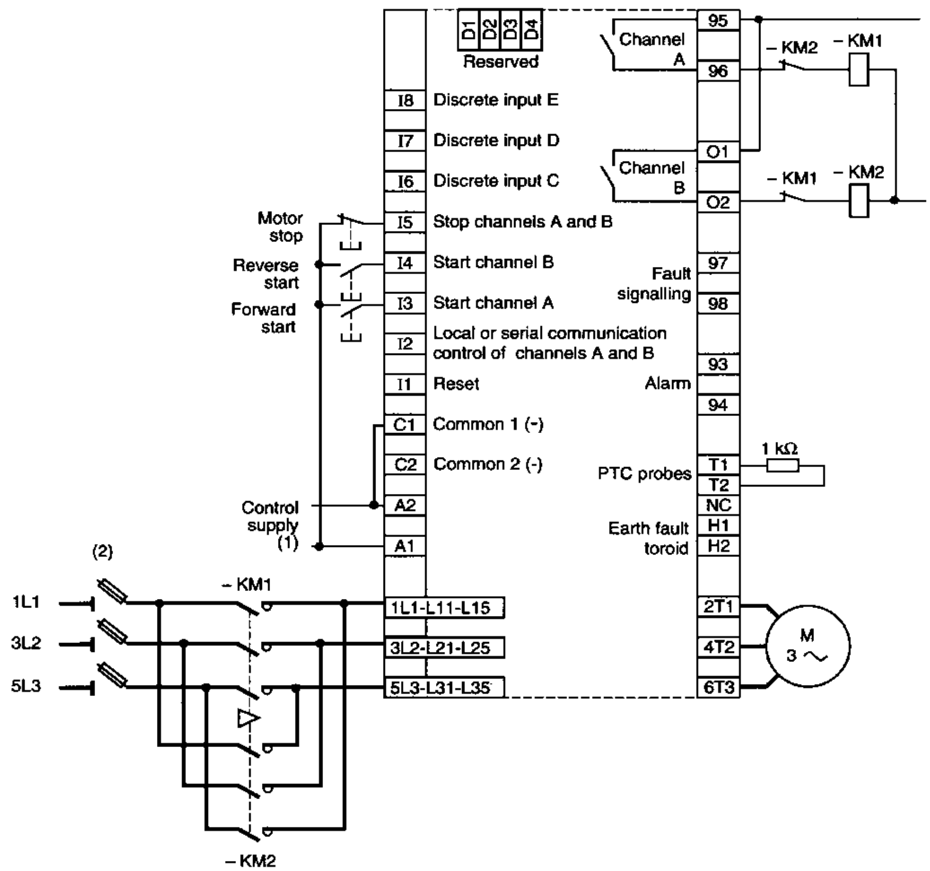
Control from front face of relay
Channels A and B set for independent control



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.

Motor control: Full-voltage reversing starting

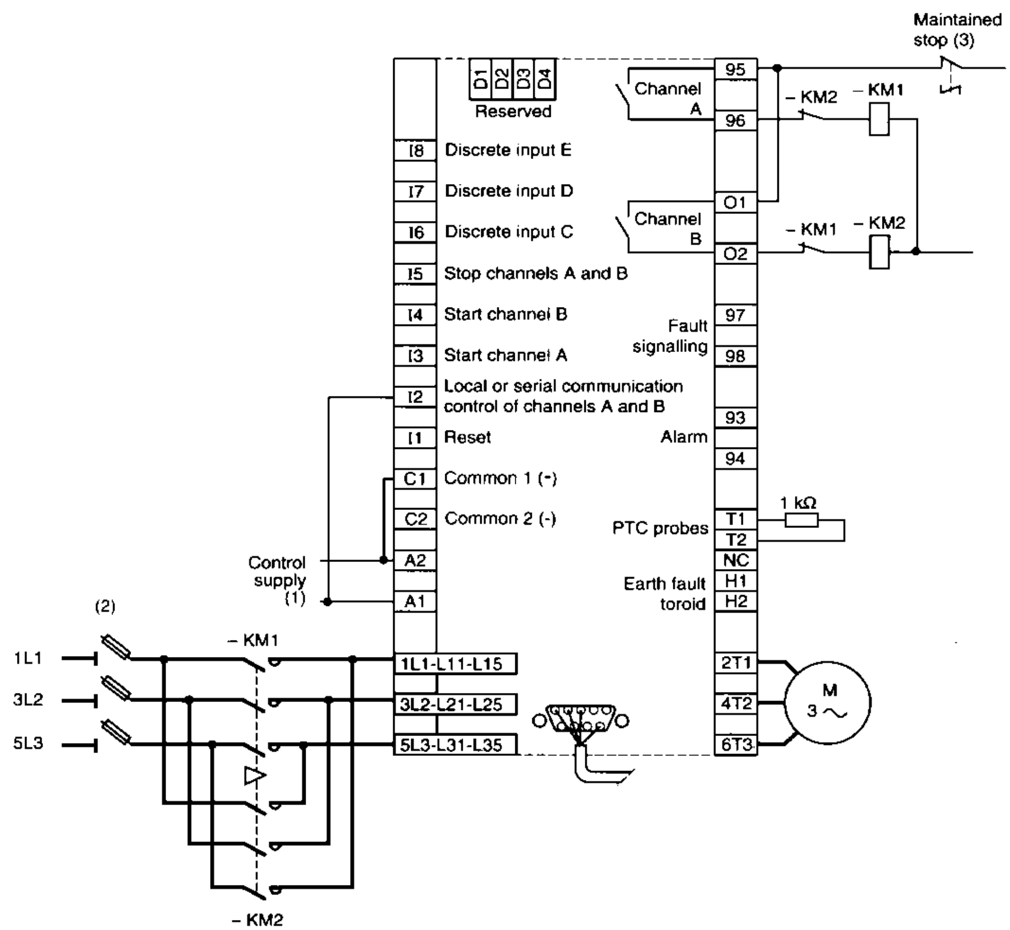
Control via discrete inputs of relay
Channels A and B set for reversing control



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.

Motor control: Full-voltage reversing starting

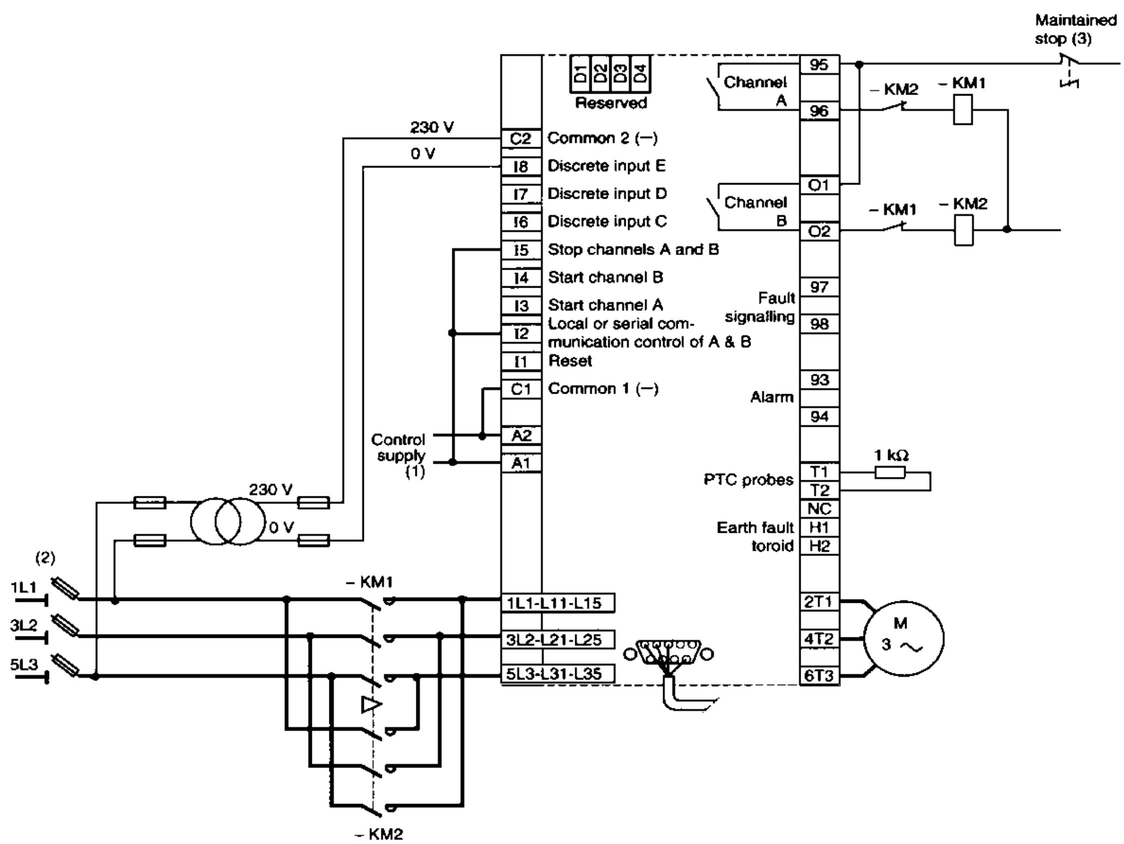
Control via serial link communication
Channels A and B set for reversing control



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

Motor control : Full-voltage reversing starting with measurement of cos φ and voltage

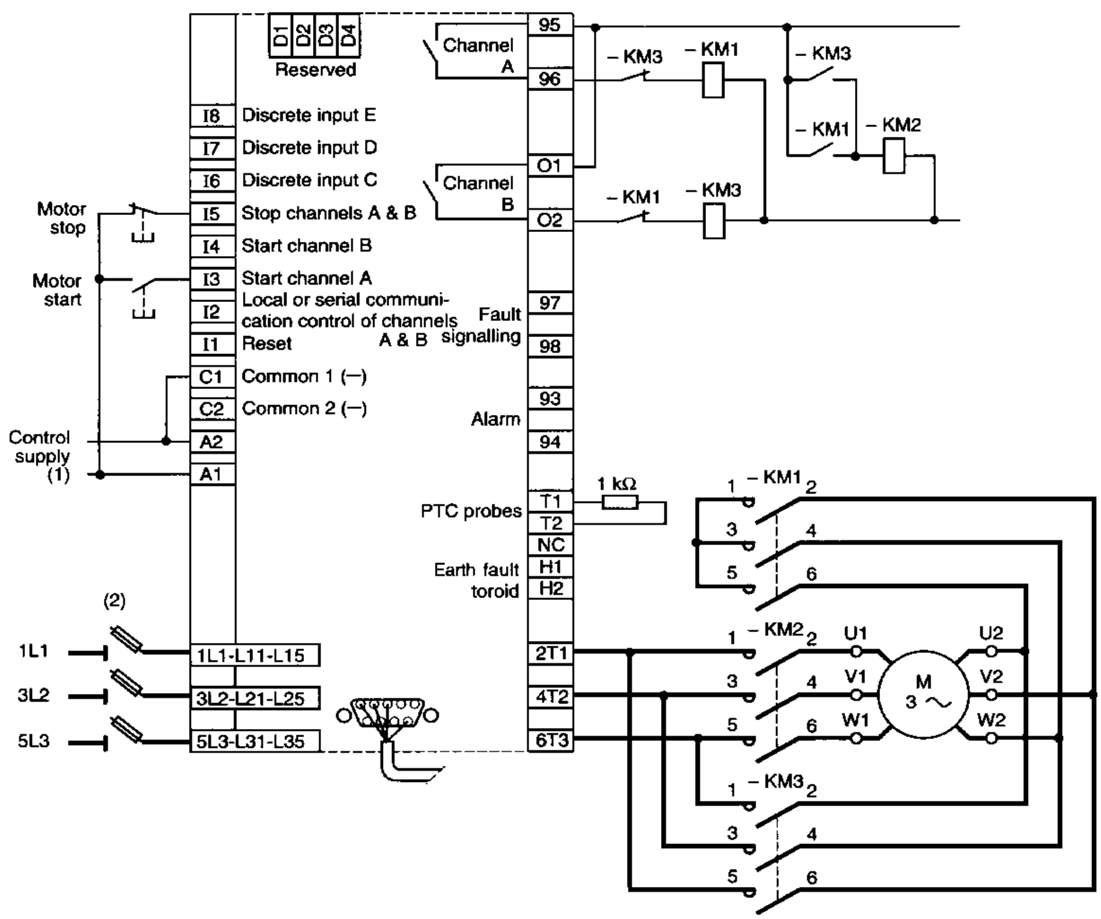
Control via serial link communication
Channels A and B set for reversing control



(1) For DC control supplies, the inputs I1 to I7 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

Motor control: Star-delta starting

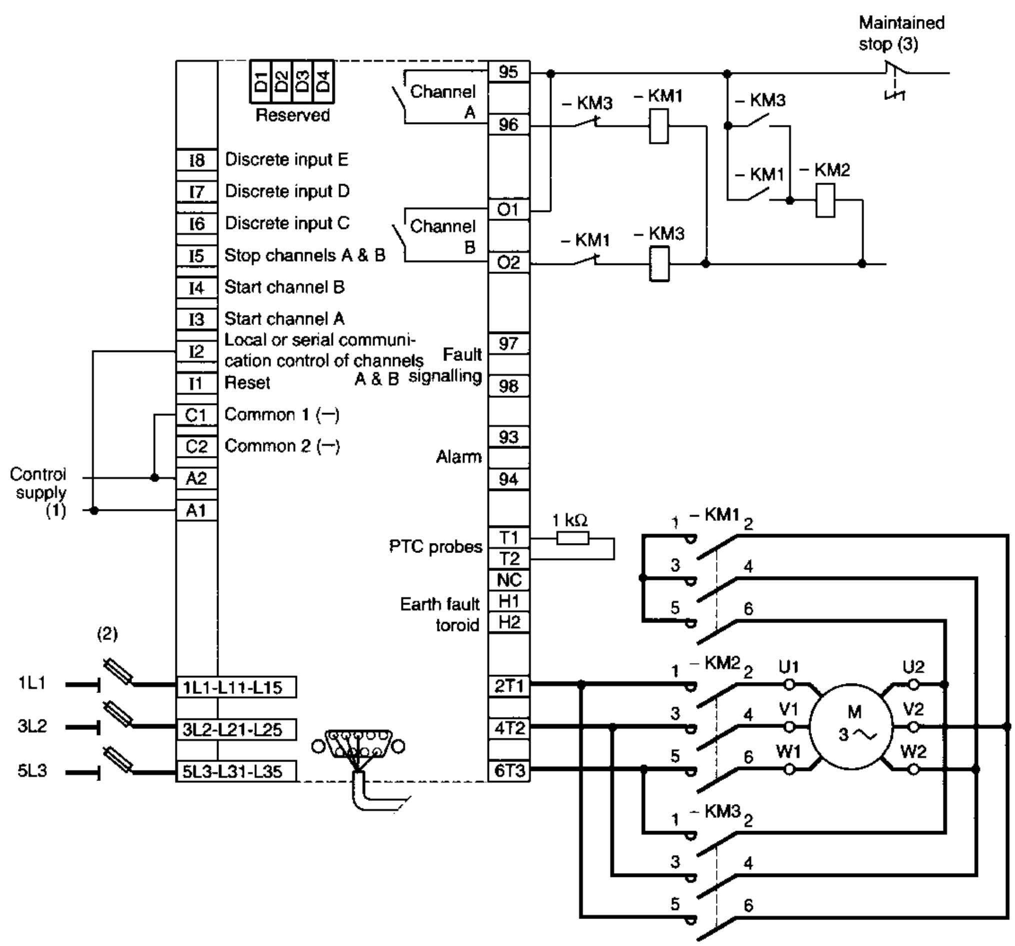
Control via discrete inputs of relay
Channels A and B set for 2-stage control



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.

Motor control: star-delta starting

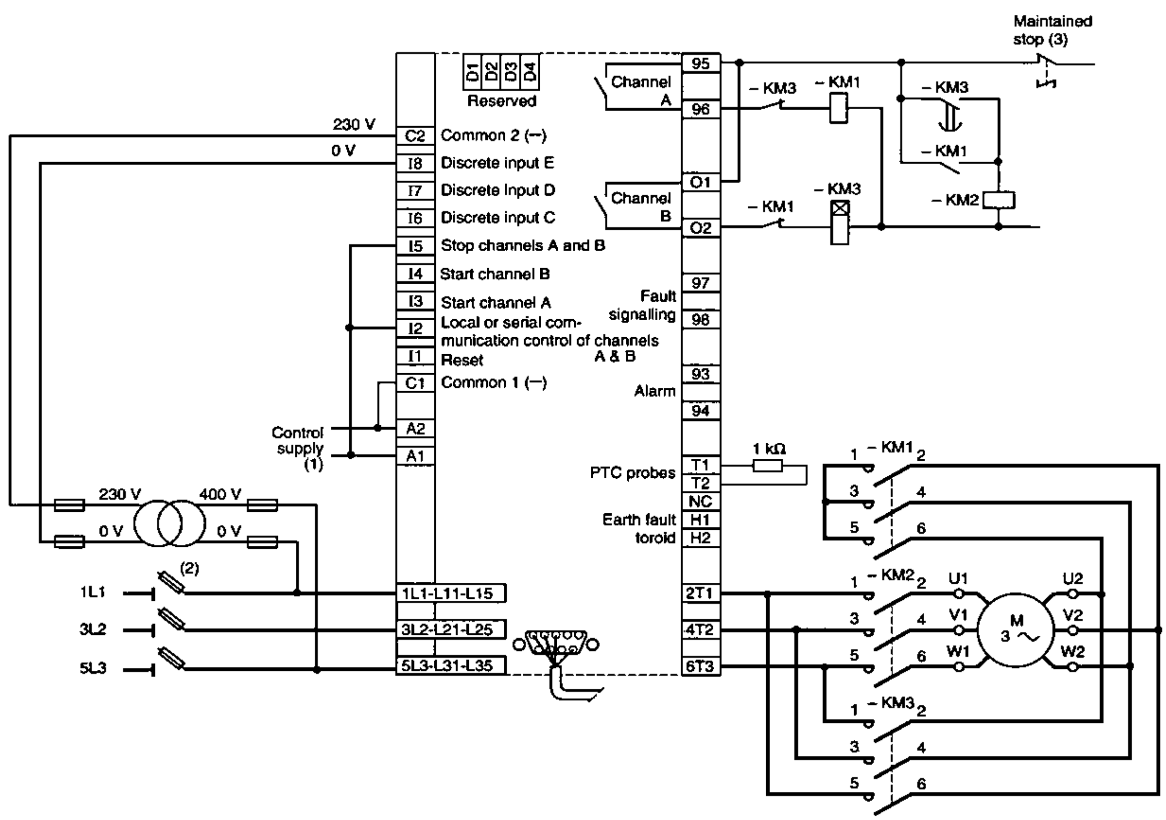
Control via serial link communication
Channels A and B set for 2-stage control



(1) For DC control supplies, the inputs I1 to I8 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

Motor control: star-delta starting with adjustable time delay

Control via serial link communication
Channels A and B set for 2-stage control



(1) For DC control supplies, the inputs I1 to I7 must be connected to the positive line.
(2) Disconnect and short-circuit protection must comply with NEC and local codes.
(3) Local maintained stop must be connected when serial link is used.

9110IM9701