

P-2M-L

Optical/Electrical Interface Unit

P2ML/EN M/B11

Software version: 01



User Manual

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1. GENERAL DESCRIPTION

The P-2M-L Optical/Electrical Interface Unit is designed for teleprotection equipment (such as the P54x). It converts the optical signal from teleprotection equipment to an electrical signal (compliant with ITU-T G.703 2048Kbit/s). The converters can be connected to a telecommunications network to extend the communication distance of the teleprotection equipment.

The P-2M-L has alarm relay output nodes and functions for recording events. It can display current status and the recorded event can be read out using a PC or an LCD display.

2. TYPICAL APPLICATION

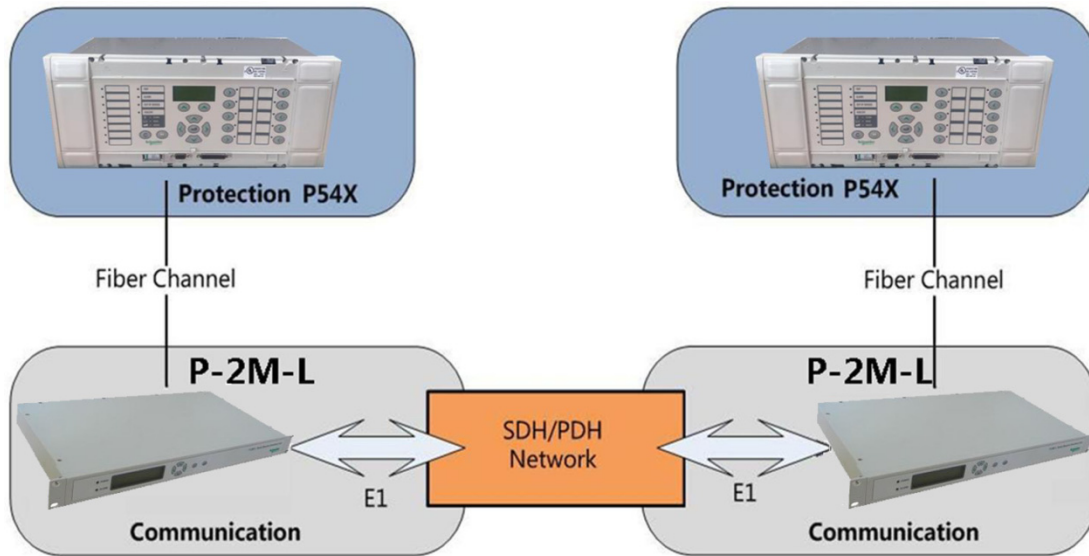
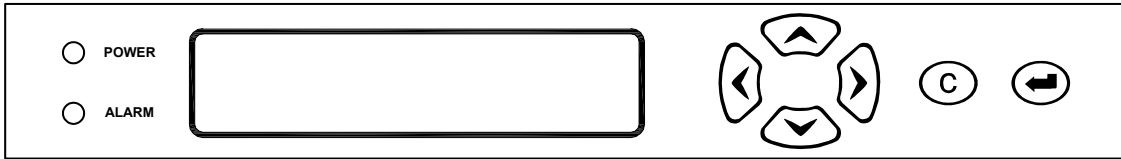


Fig. 1 : Typical application of the P-2M-L

4. SIGNAL INTERFACE AND CONNECTION

4.1 Front Panel

The front panel has 2 LED indicators, one LCD display and six keys.



Name	Color	Description
POWER	GREEN	Power supply indicator. Lit when power on.
ALARM	RED	Fault indicator. Lit when one or more alarms are present. Will be cleared automatically, if there is no alarm.

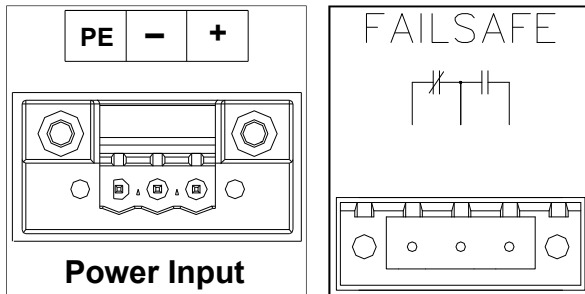
The LCD display and the key functions will be described below

4.2 Rear Panel

4.2.1 Power Supply Interface and Alarm Relay

The P-2M-L power supply and relay have 3-pin connectors (PHOENIX CONTACT Ltd.) and should match the relevant plug (model: MSTB2.5/3-STF-5.08).

The definitions of its pins are as follows:

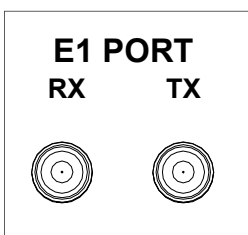


POWER	PE	Protective conductor terminal (protective earth), which is connected to the chassis interior.
	- / +	Negative and positive polarity of the power supply, care should be taken to use the correct polarity.

FAIL SAFE: Alarm relay output	\uparrow : Common node ; $\overline{\text{---}}$: Normally-off ; --- : Normally-on
	$\overline{\text{---}}$ Will be closed and --- will be opened if the alarm signal starts $\overline{\text{---}}$ Will be opened and --- will be closed if the alarm signal ends.
	The relay is a Panasonic product (model: ST1-DC5V-F), see table below for some electrical characteristics. Please refer to Panasonic's official specification document for updated values and further details.

ST1-DC5V-F Characteristics

Max. switching power (resistive load)	2000 VA / 150 W
Max. switching voltage	380 V AC / 250 V DC
Max. switching current	8 A

4.2.2 The Electrical Port Connected to the Multiplexer

The electrical signal port connecting to the multiplexer, namely the E1 interface, consists of a pair of type 1.6/5.6(L9) RF connectors.

E1	RX	Signal input, its shell should be grounded.
	TX	Signal output, its shell should be grounded.

Note :

The 75Ω coaxial cable should be used, and its length should be as short as possible, normally no more than 100 m.

Recommended is a coaxial cable with the following characteristics:

Product Description: Tinned copper conductor, insulated foam PE (skin-foam-skin), tinned copper double braid, coverage 95%, white flame-retardant PVC jacket.

Parameter:

CONDUCTOR CONSTRUCTION (mm) : 7/0.18

NOM. CORE O.D. (mm) : 2.45

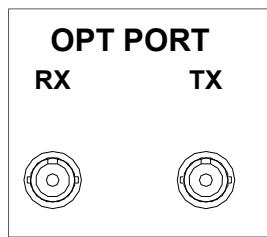
NOM. O.D. (mm) : 4.7±0.2

IMP (Ω) : 75

RL (dB) : 20

ATT. (dB/100m) : 1 MHz ≤ 1.5
 13 MHz 5.3 ±0.4

4.2.3 The Optical Interface Connected to the Protection Relays



The optical signal interface connected to the protection relays has a pair of ST optical connectors.

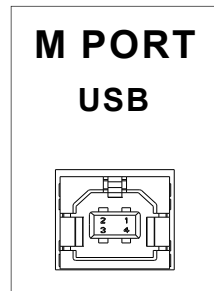
OPT	RX	Optical receiver
	TX	Optical transmitter

Optical fiber:

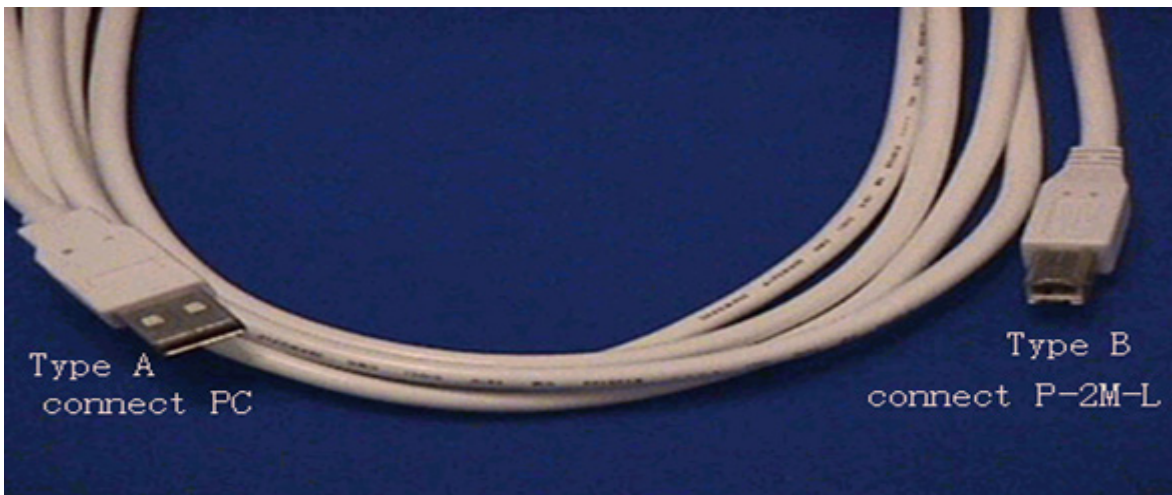
Multi-mode fiber of 50/125 μm or 62.5/125 μm (P-2M-LXA).
 Single-mode fiber of 9/125 μm (P-2M-LXB).

4.2.4 The Control Port Connected to the PC

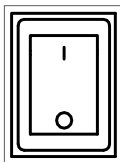
The control port connecting to the PC is a USB-type connector.



USB cable:
USBA – USBB.

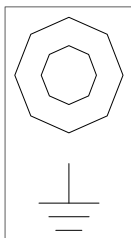


4.2.5 The Switch



Power on when pressing “I”
Power off when pressing “O”

4.2.6 Case Grounding



Must be grounded (earthed)

5. INSTALLATION AND OPERATION

5.1 Installation

The P-2M-L is in a standard 19" 1U rack, and only trained personnel should be in the vicinity of the rack.

5.2 Cable Connection

The cables should be connected correctly as described above.

The length of cables connected to the multiplexer should not exceed 100 m.

The following special points should be noted:

- A. Voltage value and its -/+ polarity of the power supply and use of a flexible cord 0.5 mm² minimum;
- B. Good conductivity to the protective conductor terminal (protective earth);
- C. Contact capacity of the alarm relay;
- D. Rx/Tx ports of electrical and optical signals

5.3 Frequently Asked Questions

- 1) When the OPT_LOS message is issued (i.e. when the optical signal data of the protection relay cannot be received), please ensure that the optical interface of the P-2M-L is connected correctly to the interface of the protection relay. If it is correct, please check that the fiber type (single-mode or multi-mode) is matched, the fiber is undamaged and the protection relay works normally.
- 2) When the E2M_LOS message is issued (i.e. multiplexer electrical signal data cannot be received), please ensure that the electrical interface of P-2M-L is connected correctly to the interface of the multiplexer. If it is correct, please check that the cable impedance (75 Ω) is matched, that the cable is undamaged and the multiplexer works properly.
- 3) When either the OPT_bitERR message (i.e. the optical signal data of the protection relay has a bit error) or the OPT_ERR3 message (i.e. the BER of the received optical signal data of the protection relay is more than 10⁻³) is issued, please ensure that the fiber is connected reliably (especially the joints) and that the fiber type is matching, or change the clock type of the protection relay.
- 4) When the E2M_bitERR (i.e. the received multiplexer's electrical signal data has a bit error) or the E2M_ERR3 message is issued (i.e. the BER of the received multiplexer's electrical signal data is more than 10⁻³), please ensure that the cable is connected reliably (especially the joints) and the impedance is matched.
- 5) When the BatFault (Interior battery fault) occurs, the battery should be replaced. Please contact the local support team.
- 6) For P-2M-LXB, when the OPT_PRESENT (i.e. the optical device doesn't exist) or the OPT_TX_FAULT (i.e. the optical device transmission is faulty) message is issued, please contact the local support team immediately.

5.4 Operation

5.4.1 Monitor Software Operation

5.4.1.1 Hardware and Software Requirements

Hardware requirements:

- 2 GHz CPU (or better)
- Min. 500 MB RAM
- Min. 500 MB free space on the system drive
- Additional 500 MB free space somewhere on the hard drive
- At least one serial port (e.g. the USB to Serial port, see below)

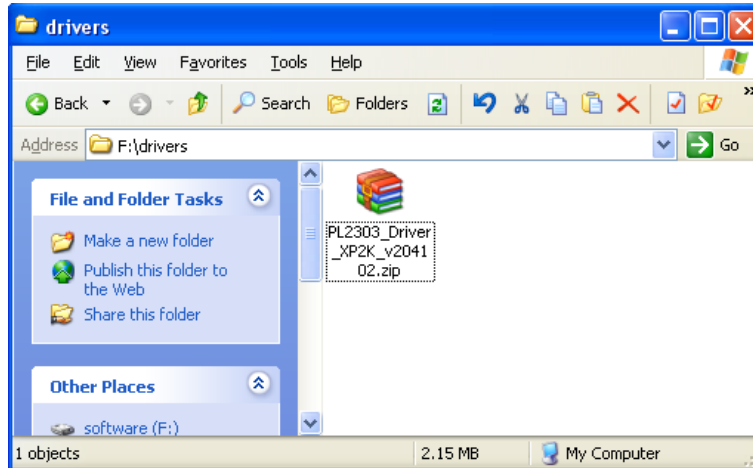
Software requirements:

- Any of the following Microsoft Windows versions:
 - Microsoft Windows XP SP3
 - Microsoft Windows 2003 SP2
 - Microsoft Windows Vista SP1 (or later)
 - Microsoft Windows Server 2008
 - Microsoft Windows 7
- Windows Installer 3.1 (or later)
- .NET Framework 4 (will be automatically installed if necessary)

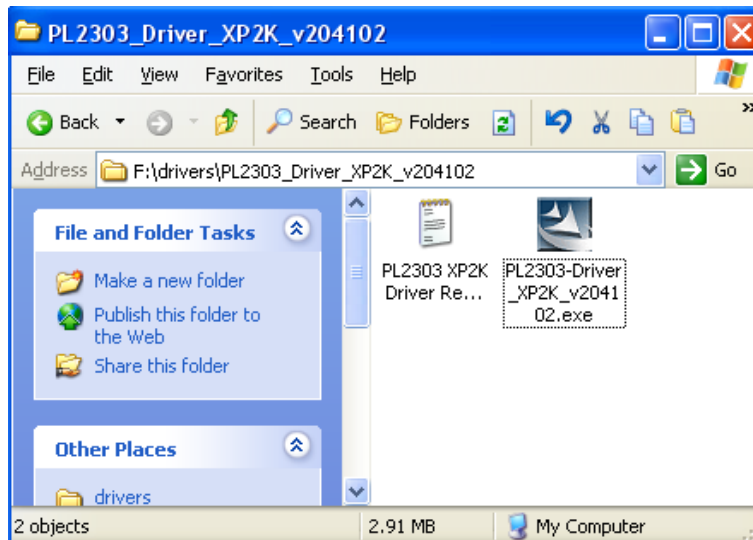
5.4.1.2 Software Installation and Setting

Before operating the P-2M-L, please carry out the following actions.

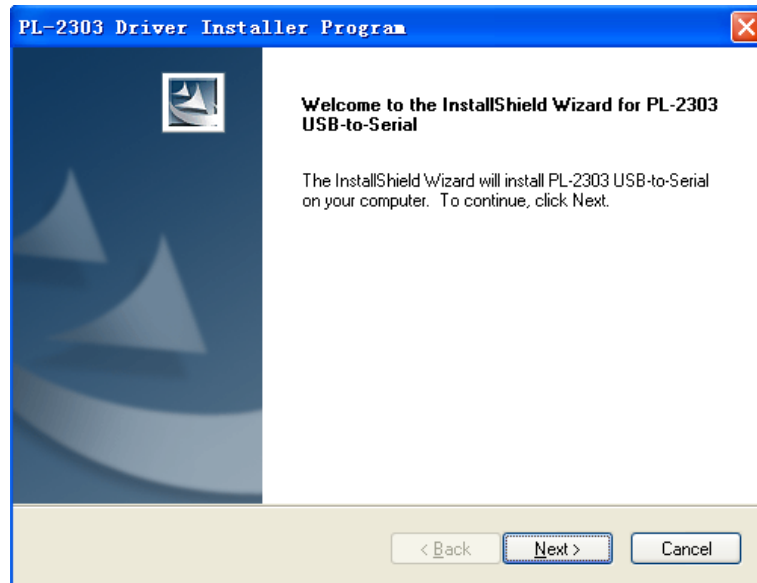
- 1) USB to serial driver (named PL-2303 Driver) Installation
 - A. Enter the driver directory, as shown.



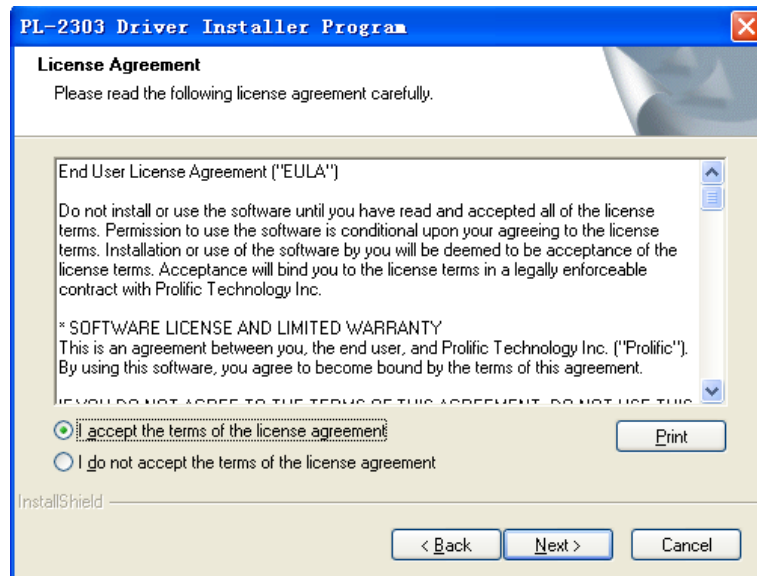
- B. Decompress and double click.



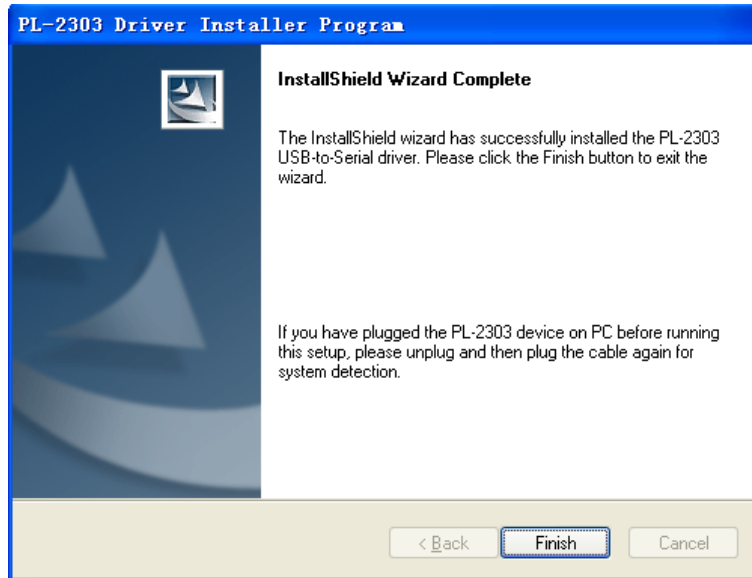
C. Click "Next".



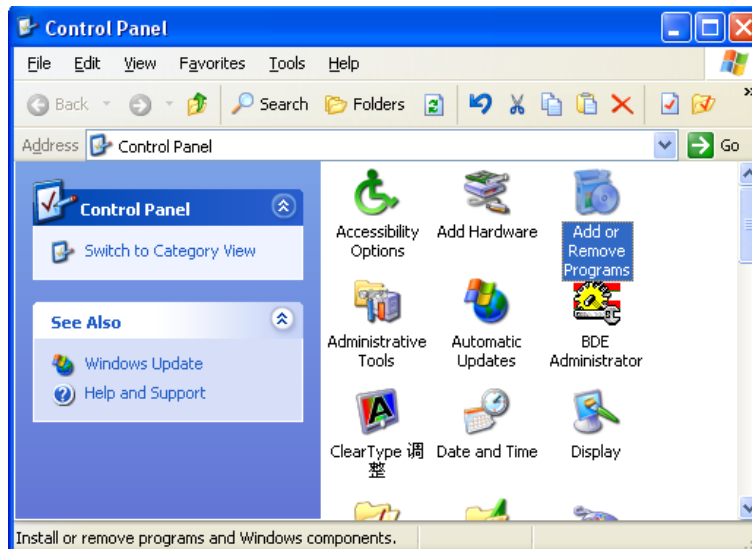
D. You have to accept the license agreement in order to proceed.
(Check "I accept" and click "Next".)



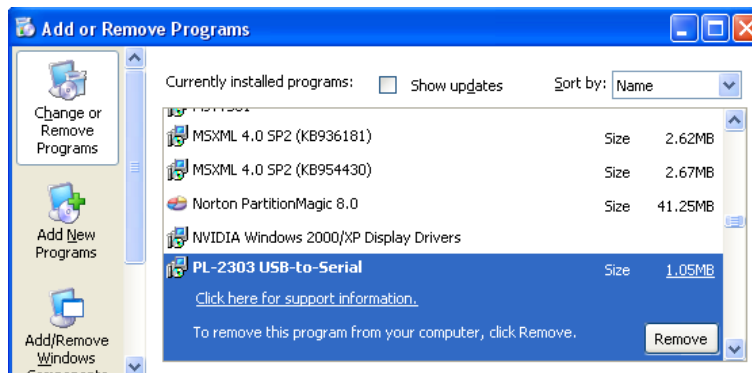
E. Click "Finish", the installation is complete.



F. Go to the Control Panel, select "Add or Remove Programs".



G. The PL-2303 USB-to-serial driver has been installed successfully if it appears in the list of installed programs.

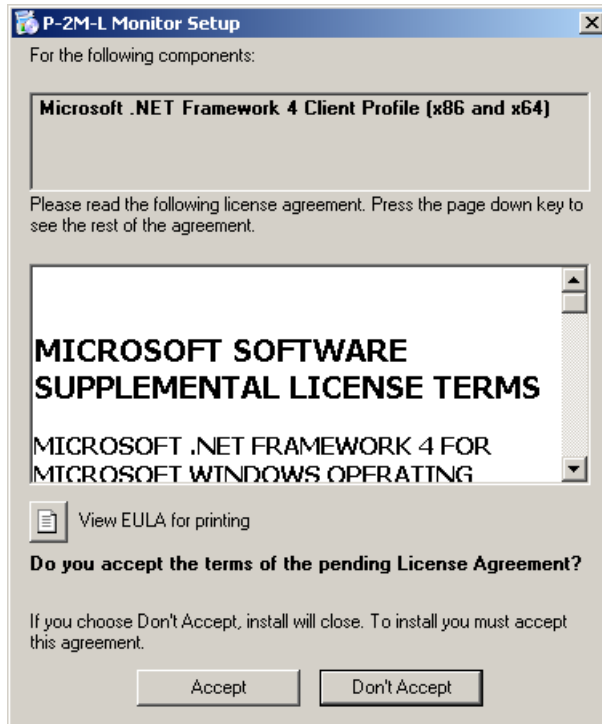


2) Installation of the Monitoring Software

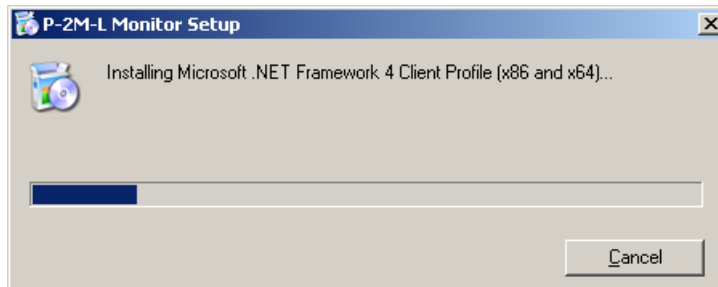
A. Start the setup program.

If the .Net Framework 4 is not yet installed, its installation wizard is launched first.

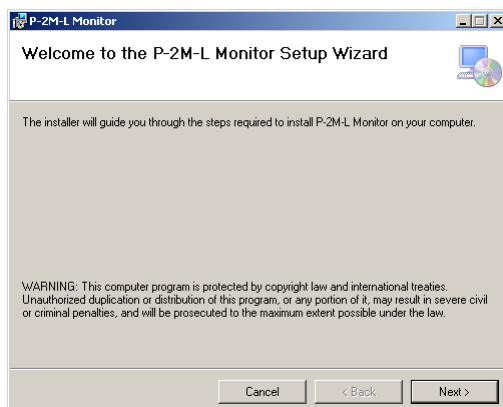
You have to accept the license agreement in order to proceed. (Click the “Accept” button.)



Note that the installation process will take some time, depending on the hardware of the PC. It is not recommended to abort the installation, because in this case, the whole installation process will have to be repeated at a later time.

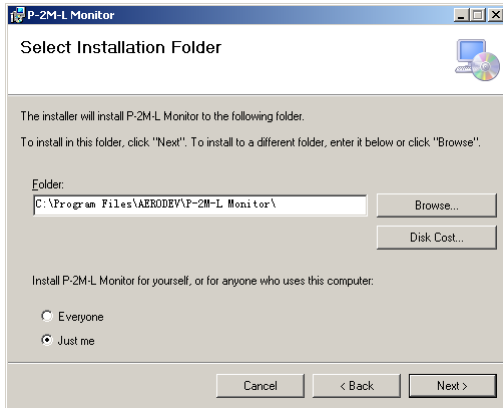


B. Afterwards the installation wizard of the P-2M-L monitoring software starts.

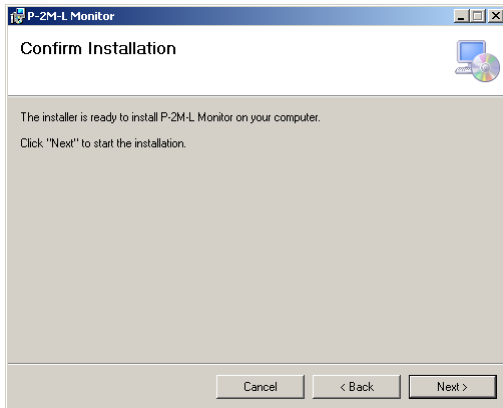


Click “Next”.

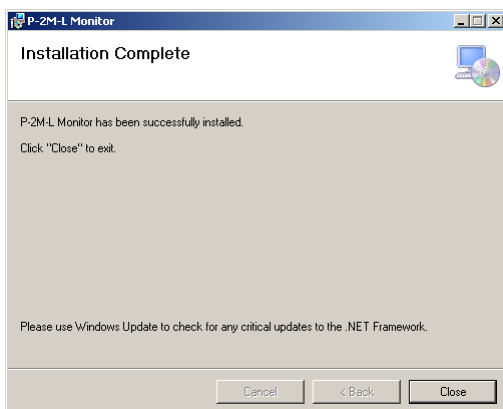
- C. Select the installation directory and the user type.
The “Browse” button lets you select a particular installation directory.
Check either “Just me” or “Everyone”, depending on who will use the software.
Finally click “Next”.



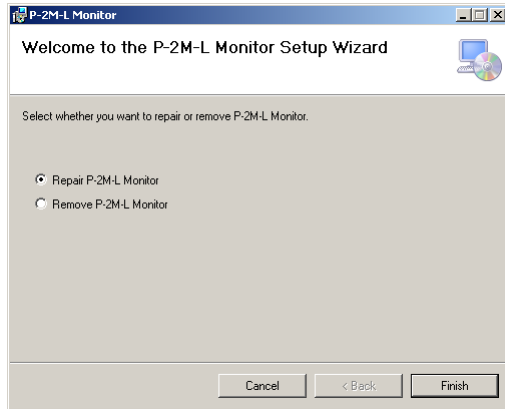
- D. Click “Next” once again to proceed.



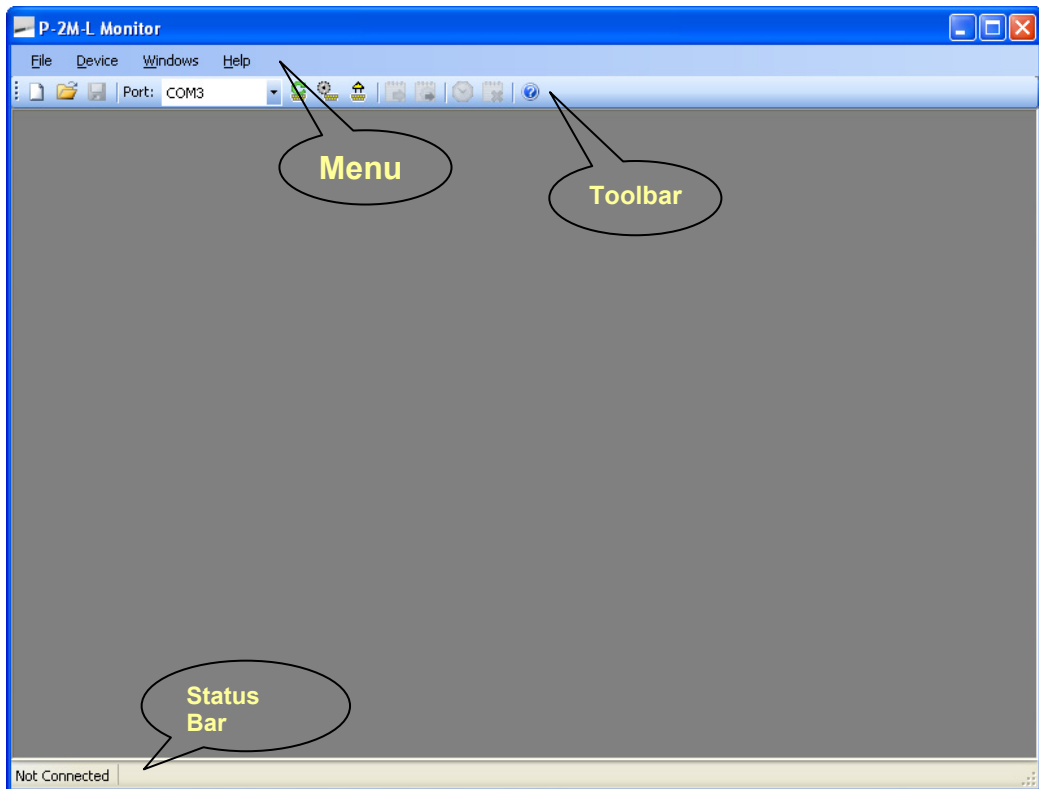
- E. Wait until the installation is finished.
When the dialog reports “Installation Complete”, click the “Close” button.



- F. Note that the software installation can be repaired or removed at a later time, if necessary. Launch the wizard and select the required operation, then click “Finish”.

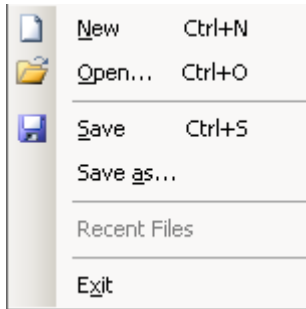


5.4.1.3 Main Window of the Monitoring Software



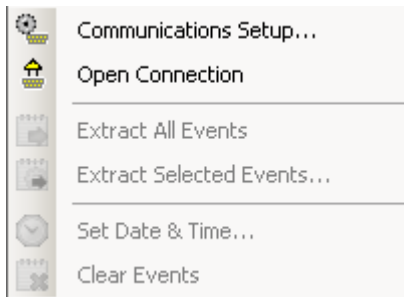
5.4.1.4 Menu

Menu items under “File”



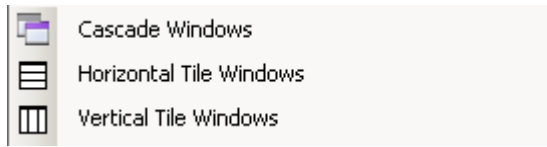
Menu Item	Description
New	Open a new event window.
Open...	Select and open an event log file.
Save	Save the active event window context to current log file.
Save as...	Save the active event window context to a new log file.
Recent Files	List of recently used event log files.
Exit	Quit the program.

Menu items under “Device”



Menu Item	Description
Communication Setup...	Select the COM port.
Open/Close Connection	Open or close the selected COM port.
Extract All Events	Send command to extract all events from the device.
Extract Selected Events...	Select event types and send command to extract them from the device.
Set Date & Time	Set device date and time.
Clear Events	Clear all events on the device.

Menu items under “Windows”



Menu Item	Description
Cascade Windows	Organize windows to cascade arrangement.
Horizontal Tile Windows	Organize windows to horizontal tile arrangement.
Vertical Tile Windows	Organize windows to vertical tile arrangement.
Windows list	Select an event window from a list.

Menu items under “Help”

Menu Item	Description
Help	Launch the About information window.

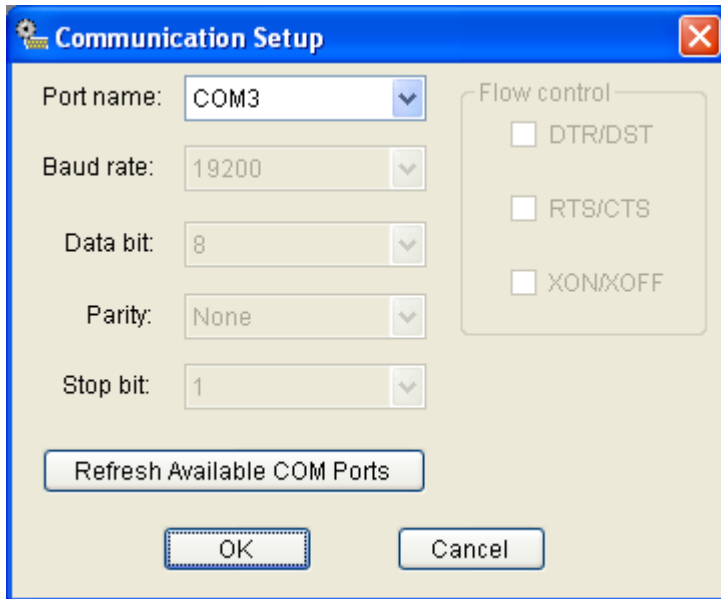
5.4.1.5 Toolbar

The following buttons are available on the toolbar:

Button	Name and Function
	New. (Same functionality as the “File->New” menu item.)
	Open. (Same functionality as the “File->Open” menu item.)
	Save. (Same functionality as the “File->Save” menu item.)
	Selection of the COM port.
	Refresh COMS. Refresh the available COM ports.
	Communication Setup. (Same functionality as the “Device -> Communication Setup” menu item.)
	Open/Close Connection. Checked if the connection is established, unchecked otherwise.
	Extract All Events. (Same functionality as the “Device-> Extract All Events” menu item.)
	Extract Selected Events. (Same functionality as the “Device-> Extract Selected Events...” menu item.)
	Set date and time. (Same functionality as the “Device-> Set Date & Time” menu item.)
	Clear Events. (Same functionality as the “Device-> Clear Events” menu item.)
	About. (Same functionality as the “Help->About” menu item.)


5.4.1.6 Connection to the Device

Communication setup:




Select the available COM port, then click OK.

Open the Connection:


Select the “Device->Open Connection” menu item or click the  button.
Note that all device operations require an established connection.


Close the Connection:

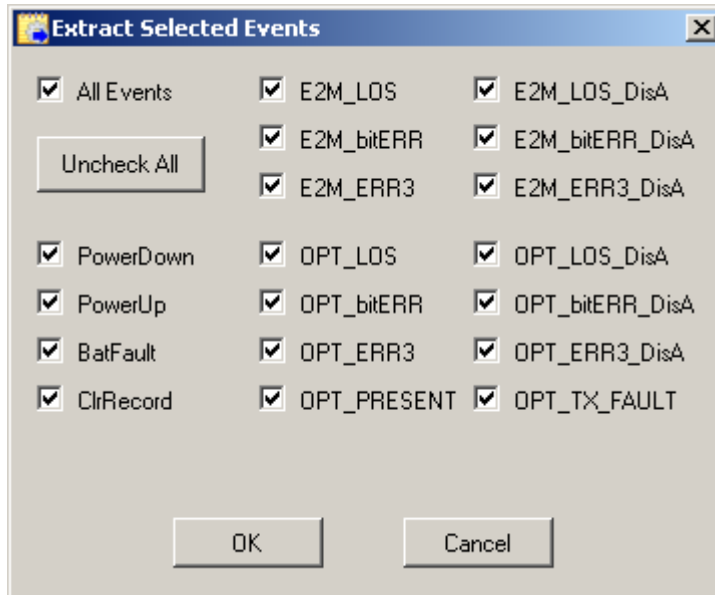
When the COM port is open, select the “Device->Close Connection” menu item or click the  button.

It is strongly recommended to first close the connection before the serial port cable is unplugged from the device.

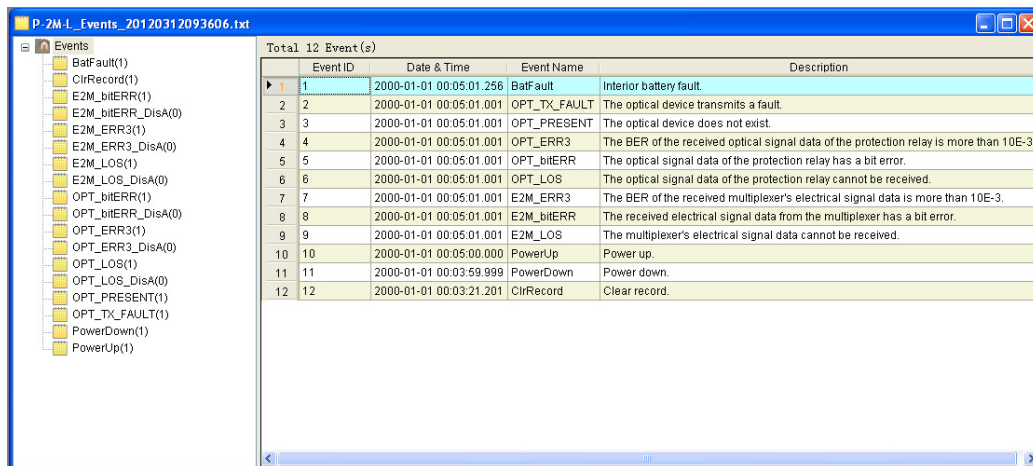
Extract Events:

Select the “Device->Extract All Events” menu item or click the  button to extract all events stored in the device.

Select the “Device->Extract Selected Events” menu item or click the  button to extract particular events stored in the device. The following selection dialog will be launched to allow for selecting the types of events that you are interested in:




Then the Event View window will display all the event types that are checked (or all events in case of “Extract All Events”).




Note that events of type OPT_PRESENT and OPT_TX_FAULT are available only for the P-2M-LXB variant.

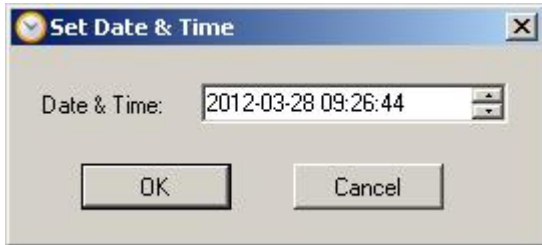
Click any column header in the Event View window to sort by the respective data.

Select the “File->Save” menu item or click the  button to save the events to a file.

5.4.1.7 Miscellaneous Settings

Set Date and Time


Select the “Device->Set Date & Time” menu item or click the  button to launch the “Set Date & Time” dialog.

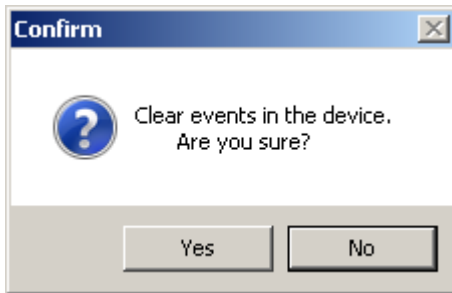


The default value is the current system date and time of the PC.
The acceptable range is from “2000-01-01 00:00:00” to “2099-12-31 23:59:59”.

Finally click OK to send the time setting command to the device.



Clear Events


Select the “Device->Clear Events” menu item or click the  button to erase all events that are stored in the device. A confirmation dialog will be launched to prevent any inadvertent loss of data.





5.4.2 LCD Display Operation

5.4.2.1 LCD Operations with Keys

After power on, the system will display the manufacturer and the name of the equipment and perform self-testing. If an alarm arises, it will enter the alarm interface and display the type of alarm. If there is no alarm, it will enter the operation interface and display the BOX temperature, the current-time characteristics, the optical transmission power and (in case of the P-2M-LXB variant) the optical reception power. When there is an alarm, pressing the  key will toggle between the operation interface and the alarm interface. In the operation interface, when the alarm disappears, pressing the  key can only show the latest alarm type once.





Pressing the  key will lead to the password interface (default password is 6666). If the password is correct, it will go to the main menu; if wrong, it will enter the original interface. The main menu has four options as follows:

Change Password; Set Time; Read Event; Clear Record.

You can set the default option by using the four cursor keys and pressing the  key to enter, and you can press the  key to return to the previous menu. The function of the submenu is as follows:



a) Change Password: Enter the old password > enter the new password > enter the new password again.



Use the “Up” and “Down” keys   to change the password digits.



Use the “Right” key  to confirm the set digit, use the “Left” key  to cancel the set digit. Use the “Clear” key  to cancel the change of password, use the “Enter” key  to confirm.

NOTE: The password must have four digits, if you enter less digits, the remainder will be filled with the digit “6”.

b) Set Time:



Use  and  to select a digit for setting.

Use  and  to add 1 or subtract 1, respectively, to the digit.

 implements the setting;  returns to the main menu.

NOTE: Optical transmission power and optical reception power is only active for P-2M-LXB





c) Read Event:

Use  and  to read out the previous and the next recorded event.

The format of the event is as follows:

First row: Year (two digits) Month Date Hour: Minute: Second. Millisecond (from left to right);
Second row: Code of Event Description (from left to right).

d) Clear Record:

Use  and  to set the operation,  to perform the operation. If “No” is set, the device will return to the main menu. If “Yes” is set, the recorded events will be cleared;  returns to the main menu.

6. TECHNICAL DATA

6.1 Power Supply

6.1.1 Auxiliary Voltage

	Auxiliary voltage (Vx)	Operating range
Ordering option 1	24 to 48 Vdc	19.2 to 57.6 Vdc
Ordering option 2	48 to 110 Vdc	38.4 to 132 Vdc
Ordering option 3	110 to 250 Vdc, and 100 to 240 Vac (rms)	88 to 300 Vdc 80 to 288 Vac

The tolerable ac ripple for dc supply is $\leq 15\%$, per IEC 60255-11: 2008.

6.1.2 Nominal Burden

Operating supply current	< 0.2A
Auxiliary supply, nominal	4 W, 35 VA ac
Auxiliary supply, maximum	7 W, 40 VA ac

6.1.3 Interruption of Power Supply

Per IEC 60255-11: 2008/ EN 60255-11:2010, and per IEC 61000-4-11: 2004 / EN 60255-11:2010.
With dc and ac auxiliary supply, the device withstands an interruption of 50 ms without de-energizing.

6.1.4 Alarm Relay

Contact	1 change over contact
Max. switching voltage	380 Vac, 250 Vdc
Max. current per contact	5 A continuous, 8 A for 0.5 s

6.2 Optical Interface

	P-2M-LXA	P-2M-LXB
Typical distance	≤ 1 km (*)	≤ 10 km (**)
Wave length	850 nm	1300 nm
Fiber	multi-mode 50/125 μm or 62.5/125 μm	single-mode 9/125 μm
Optical device	Laser class 1, per EN 60825-1/-2	FDA CDRH 21-CFR 1040 class 1
Numerical aperture (NA = $\sin \Theta$)	0.2 (50/125 μm) 0.27 (62.5/125 μm)	—
Optical output power	> -19 dBm	> -13 dBm
Sensitivity, receiving	< -25 dBm	< -30 dBm
Connector	BFOC 2.5 -(ST®)	BFOC 2.5 -(ST®)
Overload	—	≥ -8 dBm

(*) For multi-mode fiber an optical signal attenuation of 3 db/km is anticipated.

(**) For single-mode fiber an optical signal attenuation of 0.5 db/km is anticipated.

6.3 Electrical Interface

6.3.1 E1 Interface

Protocols	G.703 2048 kbit/s
Connector	1.6/5.6 (L9)
Cable type	75 Ω coaxial cable
Maximum transmission distance	Max. 100 m

Note: The photo shows a 1.6/5.6 (L9) connector which matches the 1.6/5.6 (L9) connector of the P-2M-L. It is shipped with the P-2M-L.



6.3.2 Recommended Coaxial Cable

Cable type	Coaxial cable, tinned copper conductor, insulated foam PE (skin-foam-skin), tinned, copper double braid, coverage 95%, white flame-retardant PVC jacket
Impedance	75 Ω
Conductor construction	7 / 0.18
Nom. Core o.d.	2.45 mm
Nom. o.d.	4.7 mm \pm 0.2 mm
RL	20 dB
Attenuation, 1 MHz	\leq 1.5 (dB / 100 m)
Attenuation, 13 MHz	5.3 \pm 0.4 (dB / 100 m)

6.4 Power Fuse

Type	2000T 2.0A
Rated current	2.00 A
Voltage rating	250 V
Breaking capacity	100 A at 250 V AC

6.5 Environment

6.5.1 Temperatures

Per IEC 60068–2-1:2007/IEC 60068-2-2:2007, IEC 60255-1:2009

Operating temperature range	-25°C to +55°C (-13°F to 131°F)
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Storage temperature range	-25°C to +70°C (-13°F to 158°F)
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6.5.2 Ambient Humidity Range

Per IEC 60078-2-78:2002: 56days at 93% relative humidity and +40°C.

Per IEC 60068-2-14:2000: 5 cycles -25°C to +55°C, 1°C/min rate of change.

Per EN 60068-2-30:2005: 6 cycles of 24h duration (12h + 12h)
+55°C, 93% RH and +25°C, 93% RH.

6.6 Construction and Design

Dimensions	484 mm × 232 mm × 44 mm (W × D × H)
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Weight	< 4 kg
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Degree of protection per IEC 60529	Front: IP52 Case: IP30 Rear connectors: IP10
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6.7 Electrical Tests

Standards as per IEC 60255 (Product Standards). See also standards for individual tests.

6.8 Insulation

Per IEC/EN 60255-27:2005, IEC60255-5:2000

- High Voltage Test (routine test) AC 2kV rms /1min
- Impulse Voltage Test (type test) 5 kV (peak); 1.2/50 µs; 0.5J
- The insulation resistance is greater than 100MΩ at 500Vdc

6.9 Electromagnetic Compatibility (EMC)

Type tests per IEC/EN 60255-22, (Product Standards), IEC/EN 61000-6-2 (Generic Standard)

- High Frequency Test 2.5 kV (Peak); 1 MHz:
IEC 60255-22-1, class III and 400 surges per s; test duration 2 s
- Electrostatic Discharge:
IEC 60255-22-2 class IV 8 kV contact discharge and 15 kV air discharge; both polarities
IEC 61000-4-2, class IV 8kV contact discharge, 15kV air discharge
- Radiated Immunity:
IEC 61000-4-3 Level 3, IEC 60255-22-3:2007
IEC 61000-4-2, class IV 8kV contact discharge, 15kV air discharge:
10V/m 1kHz with 80% AM: 80MHz – 1GHz and 1.4GHz – 2.7GHz
10V/m 1kHz with 80% AM: Spot tests at 80, 160, 380, 450, 900, 1850, 2150MHz
30V/m 1kHz with 80% AM: 800–960MHz, 1.4GHz–2GHz
- Electrical Fast Transient /Burst:
IEC 60255-22-4, IEC 61000-4-4, level 4 kV; 5/50 ns; 5 kHz; 100 kHz
- High Energy Surge:
IEC 61000-4-5, installation class 3, impulse: 1.2/50 µs
Power supply common mode: 4 kV diff. mode: 2 kV

- Immunity to Conducted disturbances induced by radio frequency fields:
amplitude modulated 10 V
150 kHz to 80 MHz; 80 % AM; 1 kHz, spot test at 27MHz, 68MHz
IEC 61000-4-6:2008, class III
IEC 60255-22-6:2001
- Power System Frequency Magnetic Field
IEC 61000-4-8:2009, class V, 100 A/m continuous; 1000 A/m for 3 s; 50 Hz
- Pulse Magnetic Field Immunity
IEC 61000-4-9:2000, class V 1000 A/m
- Damped Oscillatory Magnetic Field Immunity
IEC 61000-4-10:2000, class V, 100 A/m
- Power Frequency Disturbance Immunity
IEC/EN 60255-22-7:2003,
Common Mode: 300 Vrms;
Differential Mode: 150 Vrms
- ANSI Surge Withstand Capability
IEEE C37.90.1
Oscillatory Surge Withstand Capability 2.5 kV (Peak Value); 1 MHz
Fast Transient Surge Withstand Capability 4 kV; 5/50 ns; 5 kHz
- Radiated Electromagnetic Interference
IEEE C37.90.2, 35 V/m; 25 MHz to 1000 MHz
- Damped Oscillations
IEC 61000-4-18, 100 kHz/1MHz, 2.5 kV (peak value)

6.10 EMC Tests for Noise Emission

Type tests per CISPR 22/EN55022/IEC60255-25/

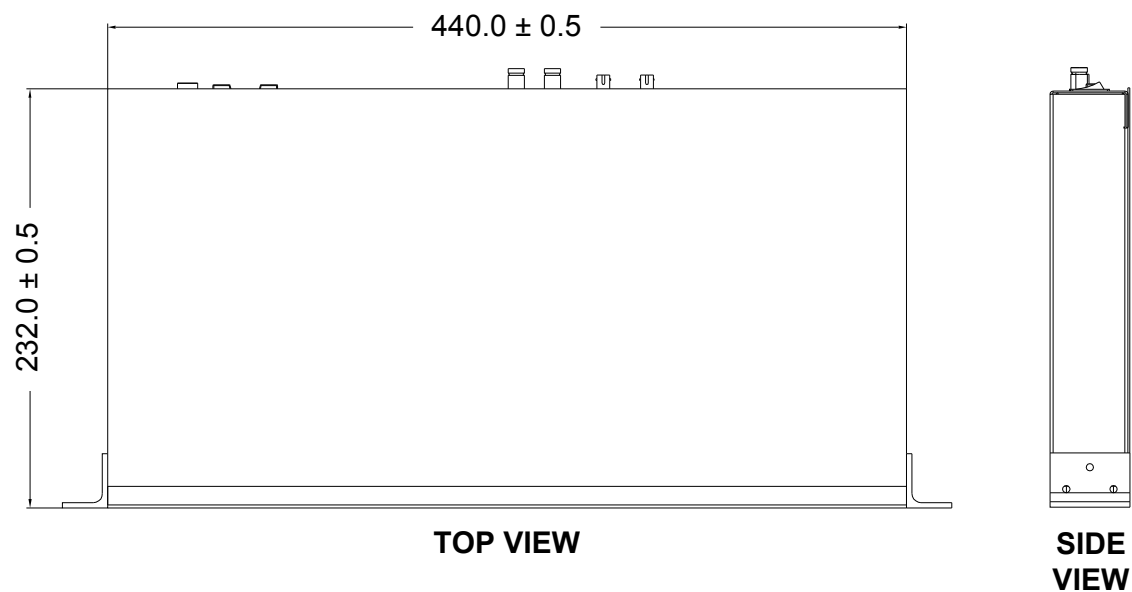
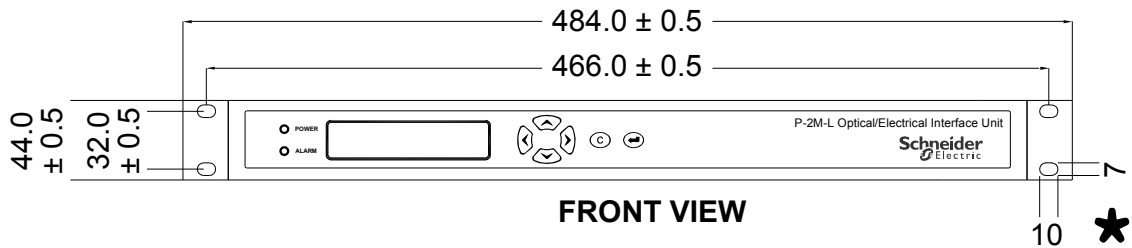
- Conducted Emission 150 kHz to 30 MHz to Limit Class A
CISPR 22/EN55022, IEC60255-25:2000
- Radiated Emission 30 MHz to 1000 MHz Limit Class A
CISPR 22/EN55022, IEC60255-25:2000

6.11 Mechanical Stress Tests

- Vibration test
per IEC 60255-21-1: 1996.
Response class 2.
Endurance class 2
- Shock and bump
per IEC 60255-21-2: 1996.
Shock response class 2.
Shock withstand class 2
Bump class 1
- Seismic test
per IEC 60255-21-3: 1995.
Class 2

6.12 Dimensions

The unit is designed for mounting in a 19" 1U rack.



* An M5/M6 screw can be used, specific size determined by the rack.

P-2M-L Dimensions (unit: mm)

7. VERSION HISTORY

P-2M-L			
Software version		Original date of release	Description of changes
Major	Minor		
01	A	2012-02-06	First release.
01	B	2012-07-18	A special Monitoring Software is now available to operate the P-2M-L. (See sections 5.4.1 ff.) Therefore operation via hyperterminal is now obsolete.



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