



Features

Rack Enclosure Size:	1U, 400mm in Depth
Input AC Voltage Range:	100..240V / 50..60Hz
Internal Modular DC Power Supplies:	12V or 24V Supplies (360.. 1632W)
Space for Devices:	Up to 4 LDDs and/or 4 TECs; Third-Party Devices
Data Interfaces: Electrically Isolated (>1kV)	- Ethernet 10/100 MBit/s - USB (Virtual Com Port) - RS485 - RS232
Digital I/O Signals: Electrically Isolated (>1kV)	- 3 Digital Inputs - 1 Digital Output
Human Machine Interface:	Backlit 2x40 Character Display and 5-Way Navigation Switch for Local Monitoring and some Main Settings
Status Indication:	2 LED (Dual Color)
Forced Air Cooling:	Temperature-Dependent Fan Speeds
Max Ambient Temperature:	Full load up to 40 °C Half load up to 45 °C

Advanced Operation

Remote Control:	LDD Service Software or/and TEC Service Software or/and 'MeCom' Protocol
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Applications

- Optics (Laser Diodes, Crystals, ...):
- e.g. autonomous turn-key solutions for comprehensive control (supply, cooling) of ps lasers
- Electronics (Detectors, RF References, ...):
- e.g. now-noise camera cooling
- Instrumentation (Microscopy, Materials, Biochemistry, ...):
- e.g. precision multitemperature control (thermal zones)

General Description

The LDD / TEC 19" rack enclosure LTR-1200 is a highly configurable, ready-made carrier system facilitating the integration of up to 4 devices belonging to either the LDD-Family of laser diode drivers or the TEC-Family of Peltier/TEC controllers. The system caters for power, cooling and communication.

The combination of built-in devices (models, number) is freely selectable by the customer, their application will dictate the choice (12V or 24V) and number of internal primary DC power supplies. Meerstetter Engineering will take care of the integration and provide a fully configured turnkey solution.

Up to 4 fans drag air sidewise through the rack enclosure. Their speed is managed by intelligent fan control on a dedicated PCB such that air cooling becomes effective upon prolonged use at high ratings.

For table-top operation, the rack mounting brackets can be removed.

The current status of the rack enclosure and of the built-in devices are indicated on the front side display (2x40 characters) and by dual color LEDs. The most important settings (parameters of the built-in devices and of the front side data interfaces) can be adjusted over the 5-way navigation switch.

For advanced operation and configuration, all internal devices can be addressed over one of the electrically isolated interfaces; therefore the originally supplied TEC and/or LDD Service Softwares can be used.

For continuous monitoring and control by customers' systems, the serial communication protocol 'MeCom' can be used: on one hand, it allows direct control of the each built-in LDD and TEC device, on the other hand it allows polling further information about the overall system status.

For fast signals (such as LDD pulse triggering) three digital (electrically isolated) input lines are available. Also, one digital output is available (e.g. for error indication).

The back panel is customizable and offers power output screw terminals as well as sensor connectivity for temperature or/and photocurrent acquisition.

The integration of third party hardware (such as fiber-coupled diode lasers) is possible if dimensional requirements are met.

Rack Enclosure LTR-1200 Elements and Configurations

Each rack enclosure is equipped and configured to the customer's specifications:

- Up to four LDD-Family or TEC-Family devices can be built-in
- The number of required power supplies and fans depends on types, numbers and applications of the built-in devices. Meerstetter Engineering equips the LTR-1200 accordingly
- The LTR-1200 is back panel configurable, the standard panel offers 4 power output terminals and 4 sensors inputs connectors
- It is also possible to install third party devices. Please contact Meerstetter Engineering with your enquiry

Available Power Supply Options (AC Input 100..240V / 50..60Hz)

DC Voltage	# of Supplies	Total Power Available on Internal DC Supply Nets	Comments
24V	1	408W (-10W for cooling)	
24V	2*	720W (-12W for cooling)	2x 12V → one net
24V	3*	1128W (-14W for cooling)	2x 12V plus 1x 24V → one 720W plus one 408W net
24V	4*	1440W (-16W for cooling)	Two times 2x 12V → two 720W nets
12V	1	360W (-10W for cooling)	12V systems can be used for low voltage operations. For example 2V or 4V laser diodes or low voltage Peltier elements.
12V	2	720W (-12W for cooling)	
12V	3	1080W (-14W for cooling)	
12V	4	1440W (-16W for cooling)	

* Primary power supplies can only be connected in series, thus a high power 24V net is created by 2x 12V.

Sample Configurations Using TEC-Family Peltier Controllers Only

Power Outputs (Max power assumed unless stated otherwise)	Rack Output Terminals				Primary Supplies (24V)		
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	#	DC Power	Load Factor
1x TEC 10A / 19V	TEC-1089	-	-	-	1	408W	55%
1x TEC 16A / 19V	TEC-1090	-	-	-	1	408W	85%
2x TEC 10A / 19V (limited overall to 350W)	TEC-1122		-	-	1	408W	97%
2x TEC 10A / 19V	TEC-1122		-	-	2	720W	60%
2x TEC 16A / 19V	TEC-1123		-	-	2	720W	95%
4x TEC 10A / 19V	TEC-1122		TEC-1122		4	1440W	60%
4x TEC 16A / 19V	TEC-1123		TEC-1123		4	1440W	95%
2x TEC 32A / 19V	TEC-1123	TEC-1123	-	-	4	1440W	95%

Sample Configurations Using LDD-Family Laser Diode Drivers Only

Important note concerning the integration of LDD-Family devices into LTR-1200 rack enclosures: The internal wiring from an LDD device to its back panel terminal can measure several 10cm and represents an inductive load. Therefore, fast pulsing performance will be impaired.

Power Outputs (Max power assumed unless stated otherwise)	Rack Output Terminals				Primary Supplies (24V)		
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	#	DC Power	Load Factor
1x LDD 1.5A / 15V	-	-	-	LDD-1124	1	408W	10%
4x LDD 1.5A / 15V	LDD-1124	LDD-1124	LDD-1124	LDD-1124	1	408W	27%
1x LDD 15A / 15V	-	-	-	LDD-1121	1	408W	64%
1x LDD 18A / 15V	-	-	-	LDD-1127	1	408W	76%
1x LDD 30A / 15V	-	-	-	LDD-1125	2	720W	71%
1x LDD 1.5A / 15V, 1x LDD 30A / 15V	-	-	LDD-1124	LDD-1125	2	720W	75%
4x LDD 15A / 15V	LDD-1121	LDD-1121	LDD-1121	LDD-1121	4	1440W	71%




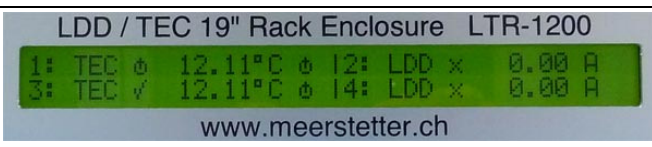
Sample Configurations Using Combinations of LDD- and TEC-Family Devices

Power Outputs (Max power assumed unless stated otherwise)	Rack Output Terminals				Primary Supplies (24V)		
	Terminal 1	Terminal 2	Terminal 3	Terminal 4	#	DC Power	Load Factor
1x LDD 1.5A / 15V, 1x TEC 10A / 15V	TEC-1089			LDD-1124	1	408W	61%
1x LDD 15A / 10V [derated], 1x TEC 10A / 19V	TEC-1089			LDD-1121	1	408W	96%
1x LDD 15A / 15V, 2x TEC 10A / 15V	TEC-1122			LDD-1121	2	720W	94%
2x LDD 15A / 15V, 2x TEC 16A / 19V	TEC-1123		LDD-1121	LDD-1121	4	1440W	83%

Status Indicators on the Front Panel

Dual Color Status LEDs			
	Sources (grouped)	Colour / Pattern	Signification
S1 (top)	LTR Components (HMI, Fan Controller)	Green, slowly blinking: 'Ready' status (no errors) Green, blinking fast: 'Run' status (no errors)	
S2 (bottom)	Built-in Devices (LDDs, TECs)		
		Red, static on: 'Error' status, output stages disabled Red, slowly blinking: Unknown Device Status, but no Error Green and red, static: 'Bootloader' status	

Grouped status code is prioritized, i.e. if one output stage is running, the grouped LED shows 'Run', if one component has an error, the grouped LED shows 'Error'.

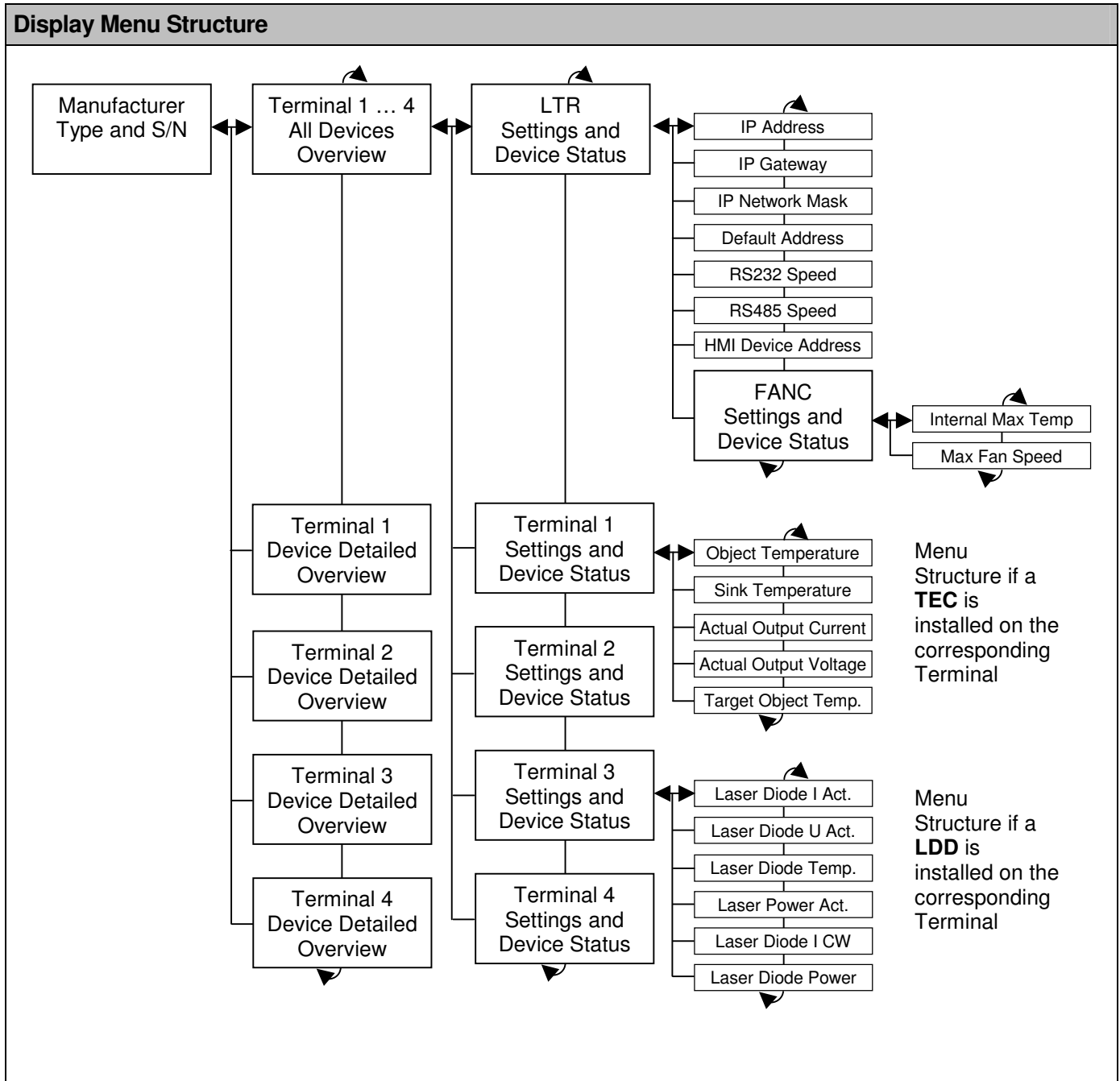
Symbols on the LCD Display				
				
First Symbol (next to TEC/LDD)	Device is 'Ready'	Other (Reset, Restart, Bootloader, ...)	Device is 'Running'	
Second Symbol (if type is TEC)	Not in Temperature Control Mode	'Wait' (not stable, yet)	Stability Reached	

The picture on the right shows the LCD display of an LTR-1200 with 4 devices built-in.

HMI (Human-Machine-Interface) Error Codes and Description			
#	Code	Description	Error Condition
80	RTOS_STACKOVERFLOW	RTOS Error	One task has a stack overflow
81	RTOS_MALLOCFAIL	RTOS Error	Can not allocate memory
100	ROUTING_LOSTFRAME	Communication Error	Routing task has lost a frame
101	COM_TIMEOUT	Communication Error	Communication timeout 3x100 ms occurred
102	ADDRESS_CONFLICT	Communication Error	Two Devices use a same Device Address
110	DEVICE_VERSION	RACK Error	HMI and device firmware versions not compatible
111	DEVICE_MISSING	RACK Error	Unassigned rack output terminal detected (missing device)
112	MENU_OWERFLOW	RACK Error	Menu memory overflow
113	UNKNOWN_DEVICE	RACK Error	Unknown internal Device recognized

For Universal Error Numbers 1 through 79, please refer to the LDD-Family or TEC-Family User Manuals.
Error Numbers 100 and above are HMI (LTR)-specific.

Display Menu Structure



Electrical Connectors on the Front Panel



Digital I/O [Left-Hand Side Ports of the Screw Connector]

General Description:

- 3 input signals (e.g. 'Enable' or 'Pulse' to LDD)
- 1 output signal (e.g. 'Error')
- Digital I/O terminals are electrically isolated (separate GND potentials)
- All digital I/Os are ESD-protected and have a series resistor

Pinout:

Default Function	DIG IO Label	Screw
LDD Enable	IN1 →	⊖
	IN2 →	⊖
Error Signal	OUT ←	⊖
LDD Pulse	IN3 →	⊖
	IO GND	⊖

Symbol	Parameter	Comments	Min	Typ	Max	Units
Digital Isolator Characteristics						
V_{ISO}	Isolation Voltage		1	-	2.5	kV
$f_{TRANSFER}$	Transfer frequency	NRZ (No Return to Zero)	0		25	MHz
t_{PHL}, t_{PLH}	Propagation Delay			45	60	ns
Input Characteristics (Digital Isolator)						
V_{IH}	Logic High Input Threshold		2.31			V
V_{IL}	Logic Low Input Threshold				0.99	V
V_{IMAX}	Max Input Voltage		-0.5		5.5	V
Output Characteristics (Digital Isolator)						
V_{OH}	Logic High Output Voltage	Output Current 20uA	3	3.3		V
V_{OL}	Logic Low Output Voltage	Input Current 20uA		0	0.1	V
V_{OHL}	Logic High Output Voltage (Hi Load)	Output Current 4mA	2.8	3.1		V
V_{OLL}	Logic Low Output Voltage (Hi Load)	Input Current 4mA		0	0.4	V
ESD Protection (between Digital Isolator and Connector)						
V_{PP}	ESD Discharge	IEC61000-4-2			100	kV
R_A	Series Resistance		170	200	230	Ω

RS485 (RS422) Interface [Right-Hand Side Ports of the Screw Connector]

General Description:

- Full-duplex or half-duplex interface
- Electrically isolated interface (Separate GND potential)
- Optional internal termination resistor (not assembled)

Pinout:

Screw	RS485 Label	Half-Duplex Connection
⊖	RS485 GND	GND
⊖	Z	B
⊖	Y	
⊖	B	A
⊖	A	

Symbol	Parameter	Test Conditions / Limitation	Min	Typ	Max	Units
Digital Isolator Characteristics						
V _{ISO}	Isolation Voltage		1	-	2.5	kV
Data Rate	Max Data Rate	All Baud Rates between 4800 bps and 1Mbps are Possible (Software Setting)			16	Mbps
V _{PP}	ESD Protection	Human Body Model			+/-15	kV
Input Characteristics (Receiver)						
V _{TH}	Differential Input Threshold Voltage		-200	-125	-30	mV
V _{HYS}	Input Voltage Hysteresis			15		mV
R _{IN}	Line Input Resistance		96			kΩ
Output Characteristics (Driver)						
V _{OD1}	Differential Output Voltage, Loaded	R _L = 100Ω (RS422)	2.0		3.6	V
V _{OD2}	Differential Output Voltage, Loaded	R _L = 54Ω (RS485)	1.5		3.6	V

RS232 Interface (D-Sub Female Connector)

General Description:

- Standard RS232 interface
- Data lines are electrically isolated (separate signal ground potential)
- Connector shield is connected to enclosure earth

Pinout:

Pin	Function
2	TxD (Data from LTR)
3	RxD (Data to LTR)
5	Signal Ground (GND)
other	Not Connected

Symbol	Parameter	Test Conditions / Limitation	Min	Typ	Max	Units
Protection Characteristics						
V _{ISO}	Isolation Voltage		1	-	2.5	kV
V _{PP}	ESD Protection	Human Body Model			+/-15	kV
Electrical Characteristics						
Speed	Communication Speed (Baud Rate)	All Baud Rates between 4800 bps and 1Mbps are Possible			1	Mbps
V _{OH}	High-level Output Voltage	TxD at R _L = 3kΩ to GND	5	5.5		V
V _{OL}	Low-level Output voltage	TxD at R _L = 3kΩ to GND	-5	-5.4		V
V _{IT+}	Positive-going Input Threshold Voltage			1.5	2.4	V
V _{IT-}	Negative-going Input Threshold Voltage		0.6	1.2		V

USB Interface

General Description:

- Data lines are electrically isolated (separate signal ground potential)
- Used by default for configuration with LDD/TEC Service Software
- Virtual COM port installed on host PC (used chip: FTDI FT232RQ)

Ethernet (RJ-45 Connector)

General Description:

- IEEE 802.3 compliance
- 100BASE-TX and 10BASE-T compliance
- Auto MDIX (auto switch between 10Mbit/s or 100Mbit/s)
- Auto crossover
- Auto negotiation
- Optional VLAN (available on request)
- Optional IEEE 1588 (available on request)

LED Description:

	Green	Orange
Off	Not connected	10Mbit/s
Blink	Activity	
On	Connected	100Mbit/s

Available Features:

- Small embedded Website
- Service Software communication
- MeCom protocol over TCP Port 50000

Electrical Connectors on the Back Panel



General notes concerning the electric potentials at internal and back panel connectors:

- By standard, the GND potentials of all built-in TEC and LDD devices are interconnected
- Consequently, all external loads and sensors to be attached to the back panel should be potential-free
- At the most, only one single potential (e.g. GND of one laser diode) may be tied to a given potential; it is however recommended to keep all loads and sensors potential-free
- Upon customer request, individual outputs can be equipped such that they are potential-free (i.e. independent of other built-in devices). Please contact Meerstetter Engineering with your enquiry

The following information is for customers to help with the confection of matching cables. Fully pre-confectioned cables are available from Meerstetter Engineering at request.

TEC Sensors Pinout Configuration	(PIN_CFG 002)
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User Connector and Cable Options		
Option	Connector Solder 7-Way	Cable 6-Way, Shielded
Manufacturer	Binder	Kabeltronik
Manufacturer Part Nr.	99-4925-00-07	2-LifYCY TP (820600800)

Pinout - Object and Sink Temperature Measurements		
Function	Connector Nr.	Cable Color
Object Voltage Sense +	1	White
Object Voltage Sense -	2	Brown
Object Current Output	3	Green
Object Current Return	4	Yellow
Sink Sense A	5	Grey
Sink Sense B	6	Pink
NC	7	-

Please connect "Current Output" and "Voltage Sense +" together to one side of the thermistor, and connect "Current Return" and "Voltage Sense -" together to the other side of the thermistor.

LDD Sensors Pinout Configuration	(PIN_CFG 003)
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User Connector and Cable Options		
Option	Connector Solder 4-Way	Cable 4-Way, Shielded
Manufacturer	Binder	Kabeltronik
Manufacturer Part Nr.	99-4909-00-04	2-LifYCY TP (820400800)

Pinout - Temperature and Photodiode Current Measurements		
Function	Connector Nr.	Cable Color
Temperature Sense A	1	White
Temperature Sense B	2	Brown
Photodiode Current Cathode	3	Green
Photodiode Current Anode	4	Yellow

TEC Sensors Pinout Configuration PIN_CFG 001 (Separate Connectors for Object and Sink °T) (Obsolete: Not for new Designs)

User Connector Cabling Options			
Option	Connector Solder 4-Way	2m Cable, Unshielded	5m Cable, Unshielded
Manufacturer	Binder	Binder	Binder
Manufacturer Part Nr.	99-3376-00-04	79-3582-52-04	unknown

Other connector options are also available.

Pinout - Object Temperature Measurement		
Function	Connector Nr.	Cable Color
Current Output	1	Brown
Voltage Sense +	2	White
Voltage Sense -	3	Blue
Current Return	4	Black

Please connect "Current Output" and "Voltage Sense +" together to one side of the thermistor, and connect "Current Return" and "Voltage Sense -" together to the other side of the thermistor.

Pinout - Sink Temperature Measurement		
Function	Connector Nr.	Cable Color
Sense 1	1	Brown
Sense 2	2	White
NC	3	(Blue)
NC	4	(Black)

AC Mains Supply (3-pol Connector for IEC C13 Cables)

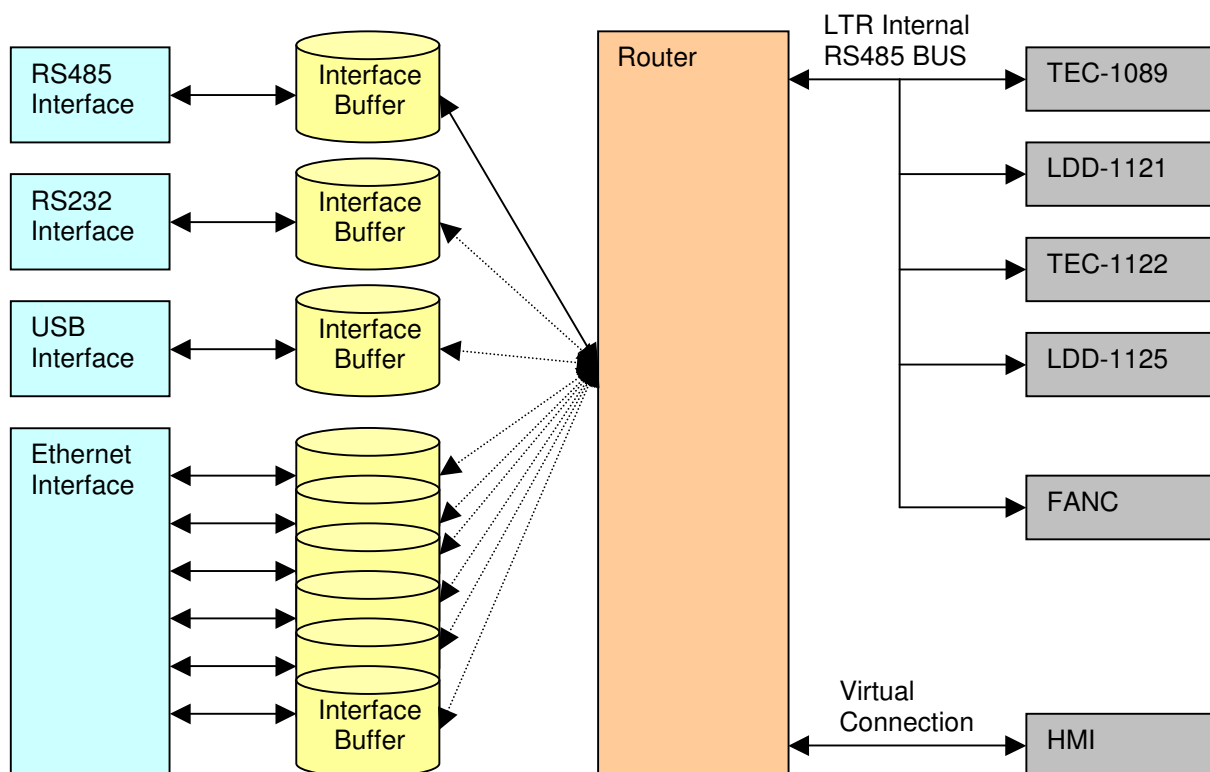
Symbol	Parameter	Test Conditions / Limitation	Min	Typ	Max	Units
Electrical Characteristics						
V_{ACnom}	Nominal Input Voltage	Single Phase	100		240	V
V_{AC}	Input Voltage	Continuous	90		264	V
$V_{ACtrans}$	Input Transients	60ms			300	V
f_{AC}	Input Frequency		47	50/60	63	Hz
P_{IN}	Input Power*	Between 1 and 4 Power Supplies	400		1600*	W
P_{IN110}	Input Power (110V _{AC})	Between 1 and 4 Power Supplies	400		1100	W
Protection Characteristics						
Fuse	Slow Fuse	Integrated into IEC C13 Housing		10		A

* When operated on 110V_{AC} mains supply, the max input power is derated to 1100W due to the 10A fuse built into the standard IEC C13 housing. Please contact Meerstetter Engineering if you require an alternative connector.

Communication Interfaces

Basic Concepts of the LTR-1200 Communication

- The LTR-1200 is equipped with several communication interfaces which can be used simultaneously.
- Every communication interface has its own receiving buffer.
- Every received message will be processed by the router. The message is forwarded to the desired device. As soon as the router task has received the responding message from the device, the message is forwarded to the corresponding interface.
- Every communication interface has the same priority. All messages will be processed successively.



Connecting LTR-1200 over Ethernet

The LTR-1200 does not support DHCP. A fixed IP Address configuration must be set over the display menu. Please set the following settings:

1. IP Address
2. Gateway Address (must only be valid if routing is required, ex. access over Internet)
3. Network Mask

Please try to access to the built-in LTR-1200 web server by entering the previously configured IP Address to your web browser.

Service Software

- Please refer to LDD/TEC user manual to connect the LDD/TEC Service Software over Ethernet.
- The default Device Address (Device to be Addressed) can be found on the 'Configuration Sheet' that was supplied with the LTR or on the Built-in web site. It usually is the same as the Terminal Number.
- The LTR-1200 accepts a total of six LDD/TEC Service Software connections at the same time.

Direct Access over Third Party Software

- The LTR-1200 provides 6 TCP Ports (Port 50000) to control the LDD/TEC drivers over Ethernet.
- Please refer to the MeCom communication protocol specifications of the LDD/TEC drivers.
- The 6 TCP Ports are the same as the 6 TCP Ports used by the Service Software Connections.

Service Software Default Address

In case of accessing the LTR-1200 over USB it may be helpful to configure a default LDD/TEC driver as standard device. This can be done by setting the 'Service Software Default Device' parameter to a specific LDD/TEC Device Address in the Display menu.

Communication Fault Management

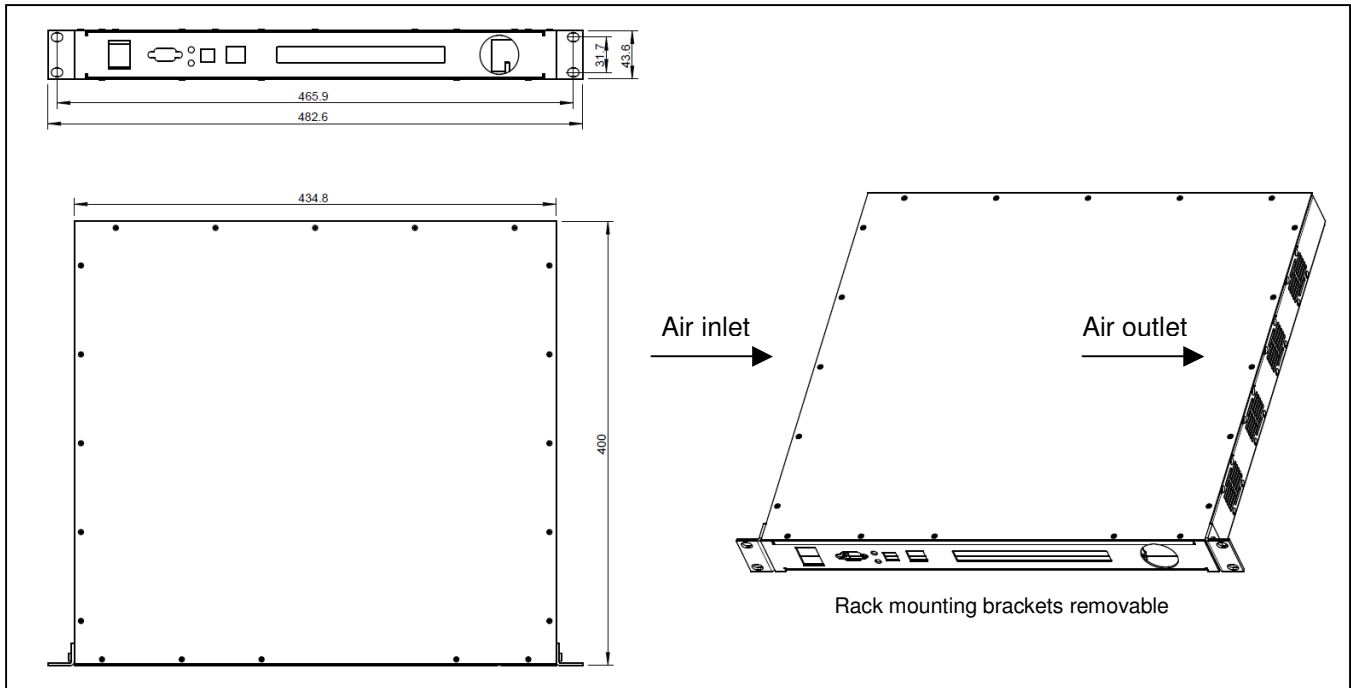
For RS485, RS232 and USB Interfaces

- A received package with a wrong CRC is not being processed, no error is generated.
- If a package is being forwarded to a device (LDD/TEC) and no answer is received from the device, no error is generated. The package must be repeated by the sending host.

For Ethernet Interface

- A received package with a wrong CRC results in closing the corresponding TCP connection.
- If a package is being forwarded to a device (LDD/TEC) and no answer is received from the device, the package is being sent to the device two more times. If still no answer is received, the TCP connection is closed by the LTR-1200.

Physical Dimensions



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