

U1601

ECS ENERGY • CONTROL • SYSTEM

3-348-844-03
3/3.00

- 64 processing channels for the calculation of energy, power and costs with freely assignable physical inputs
- Energy Control Language for the programming of analysis, monitoring and optimization applications
- 12 universal inputs: ± 5 mA, ± 20 mA, ± 10 V, S0 pulse
- LON interface for 63 U168X energy meters
- 2 analog outputs: ± 20 mA or ± 10 V, 2 relays and 4 MOS switches for the control of external processes
- 2 RS232 interfaces (115 kBit/s) for the connection of PC, modem, printer or radio-controlled clock
- 2 ECS LAN interfaces for the interconnection of individual summators over large distances
- Simple software updates via serial interface (EEPROM)



Applications

The U1601 summator expands the Energy Control System (ECS) to include the processing of analog values and simplifies the interconnection of energy meters via the LON bus. All electrical and non-electrical energy and energy consumption can thus be logged, visualized, optimized and billed to individual cost centers.

A maximum of twelve analog or pulse shaped signals can be connected to the summator, which originate from, for example, flow meters, energy meters and heat meters. Furthermore, up to 63 GOSSEN-METRAWATT U168X electrical energy meters can be connected to the U1601 summator with the easy to wire, polarity reversal protected, electrically isolated LON interface. Power supply to the pulse outputs is accomplished with an integrated 24 VDC auxiliary voltage supply.

64 processing channels calculate work, power or consumption with the above mentioned, freely assignable physical inputs. These values are summated over a defined period of time at a programmed interval, and are stored together with the corresponding maximum values.

Two electrically isolated analog outputs, four MOS switches and two relays (double-throw contacts) are available for the control of external processes, which can be operated either directly via the user specific summator background program, or via the interface at the PC.

Data exchange with the PC, or remote query via modem, is accomplished with the high-speed RS232 interface (115 kBit/s). A radio-controlled clock can also be connected for system time synchronization, as well as a report printer.

Individual summators can be interconnected over large distances with the multi-master compatible ECS LAN with freely selectable network topology, and have unrestricted access to all network user data.

Thanks to integrated high level intelligence and the customized programming language, Energy Control Language (ECL), the U1601 summator is also suitable for applications outside of the Energy Control System. These include the monitoring of distant systems and machines, as well as support for service calls and maintenance work with remote querying via modem.

The compact housing and electrical protection have been designed for rugged industrial use, and allow for mounting to a top-hat rail in accordance with EN50022. It can also be wall mounted with screws or integrated into the control panel. Easy installation is facilitated through the use of plug-in screw terminals.

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Applicable Regulations and Standards

EN 61010-1	Safety regulations for electrical measuring, regulating control, and laboratory devices
DIN 43864	Current interface for pulse transmission between impulse meters and tariff devices
EN 55081 Part 2	Limit values and measuring methods for transmitted interference
EN 55082 Part 2	Interference resistance
VDE 0470 Part 1	IP protection provided by enclosures (DIN 40050)
IEC 255-4	High-frequency disturbance test
IEC 68 Part 2-6	Basic environmental test procedure Sinusoidal oscillation
UL 94	Test for flammability of plastic materials for parts in devices and appliances

Symbols and their Meanings

Symbol	Meaning
X	Measured quantity, analog input
X2	Measured quantity upper range value
Y	Output quantity, analog output
Y2	Output quantity upper range value
R	Output load
H	Auxiliary voltage

Memory Capabilities per Channel

Energy

Cumulative Energy as of a Defined Starting Point	
E total	independent of tariff
E total T1	from tariff 1 only
E total T2	from tariff 2 only
E total T1T2	from tariff 1 + tariff 2
Cumulative Energy for Defined Time Periods	
E Day	for the current day and each of the last 10 days
E Month	for the current month and each of the last 12 months
E Year	for the current year and each of the last 4 years
E int	for all stored measuring intervals (measurement data list)
Measuring Interval Maximum Values with Date and Time	
E maxint	the 10 highest values for all measuring intervals as of a defined starting point
E maxDay	respective daily peak values for the current day and the last 10 days
E maxMonth	respective daily peak values for the current month and the last 12 months
E maxYear	peak value for the current year, and peak values for the last 4 years

Costs

Cumulative Costs as of a Defined Starting Point	
CostT1	from tariff 1 only
CostT2	from tariff 2 only
CostT1T2	from tariff 1 + tariff 2

Power

Instantaneous Value	
P inst	determined by means of the time interval between the last two meter pulses (when connected to E1 ... E12)
Measuring Interval Mean Values	
P int	for all stored measuring intervals (measurement data list)
Measuring Interval Maximum Values with Date and Time	
P maxint	the 10 highest values for all measuring intervals as of a defined starting point
P maxDay	respective daily peak values for the current day and the last 10 days
P maxMonth	respective daily peak values for the current month and the last 12 months
P maxYear	peak value for the current year, and peak values for the last 4 years

Summator Technical Data

Inputs:

The 12 inputs can be individually configured with DIP switches.

Analog Input (current)	
Input Quantity	direct current
Allowable Input Quantity Range	$-20 \text{ mA} \leq X \leq 20 \text{ mA}$
Allowable Excessive Input continuous	$\leq 2.5 X_2$
Upper Range Value (adjustable)	$1 \text{ mA} \leq X_2 \leq 20 \text{ mA}$
Control Limit	$\pm 1.25 X_2$
Input Resistance X2: 20 mA X2: 5 mA	75 Ω 300 Ω
Input Wiring	see circuit diagram, figure 1
Electrical Isolation	by means of optocoupler
Common-Mode Rejection ($\leq 120 \text{ Hz}$)	$\geq 80 \text{ dB}$

Analog Input (voltage)	
Input Quantity	direct voltage
Allowable Input Quantity Range	$-10 \text{ V} \leq X \leq 10 \text{ V}$
Allowable Excessive Input continuous	$\leq 30 \text{ V}$
Upper Range Value (adjustable)	$1 \text{ V} \leq X_2 \leq 20 \text{ V}$
Control Limit	$\pm 1.25 X_2$
Input Resistance	118 k Ω
Input Wiring	see circuit diagram, figure 1
Electrical Isolation	by means of optocoupler
Common-Mode Rejection ($\leq 120 \text{ Hz}$)	$\geq 80 \text{ dB}$

Binary Input	
Input Quantity	Direct Voltage (square-wave pulse, SO compatible)
Allowable Input Quantity Range (adjustable)	signal level: H: 0.8 mA ... 4.8 mA L: 0 mA ... 0.4 mA
Allowable Input Quantity Range continuous short-term ($t \leq 1 \text{ s}$)	$\leq 48 \text{ V}$ $\leq 60 \text{ V}$
Allowable Switching Elements	semiconductor switching device, relay
Series Resistance (internal)	4.7 k Ω
Input Wiring	see circuit diagram, figure 1
Electrical Isolation	by means of optocoupler
Pulse Duration T_{ein}	$\geq 2 \text{ ms}$
Interpulse Period T_{aus}	$\geq 2 \text{ ms}$
Pulse Frequency	$\leq 250 \text{ Hz}$
Meter Upper Range Limit	22 places, of which 15 are usable

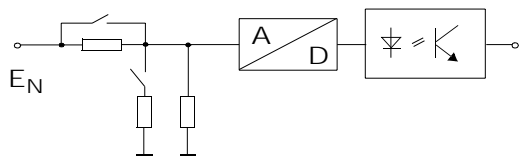


Fig. 1 Meter Input Schematic Diagram

Outputs:

The 2 analog outputs can be individually configured with DIP switches

Analog Output (current)	
Type	electrically isolated
Allowable Range	$-20 \text{ mA} \leq Y \leq 20 \text{ mA}$
Upper Range Value Y2 (linear parameter adjustment)	$1 \text{ mA} \leq Y_2 \leq 20 \text{ mA}$
Max. Output Voltage	$\leq 30 \text{ V}$
Max. Output Current	1.25 Y2
Load Range	$0 \leq 5 \text{ V}/Y_2 \leq 10 \text{ V}/Y_2$

Analog Output (voltage)	
Type	electrically isolated
Allowable Range	$-10 \text{ V} \leq Y \leq 10 \text{ V}$
Upper Range Value Y2 (linear parameter adjustment)	$1 \text{ V} \leq Y_2 \leq 10 \text{ V}$
Max. Output Voltage	1.25 Y2
Max. Output Current	$\leq 40 \text{ mA}$
Load Range	$Y_2/4 \text{ mA} \leq Y_2/2 \text{ mA} \leq \infty$
Ripple Content	$\leq 0,005 Y_2$

Binary Output	
Type	electrically isolated
Number	4
Contact Type (DIN 43864)	MOS Relay
Volume Resistance (AC/DC)	5 Ω
Pulse Duration (adjustable)	$\geq 100 \text{ ms}$
Interpulse Period (adjustable)	$\geq 100 \text{ ms}$
Output Voltage (external passive)	$\leq \pm 50 \text{ V}$
Output Current ON OFF	$\leq 200 \text{ mA}$ $\leq 10 \mu\text{A}$

Relay Output	
Switching Element	Relay
Number of Relays	2
Contact Type	double-throw contacts
Switching Voltage	250 V~, 30 V=
Switching Current	8 A resistive, 3 A inductive
Operating Cycles	$\leq 10^5$

Power Supply to External Switching Contacts	
Voltage U_V (electrically isolated)	24 V =
Voltage Tolerance	$\leq \pm 4\%$
Current (short-circuit and idling-proof)	$\leq 0.15 \text{ A}$
Ripple Content ($\leq 100 \text{ kHz}$)	$\leq 2\% V_{\text{pp}}$

RS 232 Interface (PC / Printer)

Number	2
Connectors	plug connector, Sub-Min-D9
Possible Connections COM1: COM2:	PC, modem, terminal printer, radio-controlled clock, PC
Number of Data Bits	8
Transmission Speed COM1: COM2:	115000 bits/s 115000 bits/s
Parity	even / none
Operating Mode	FDX Handshake Xon/Xoff or RTS / CTS

ECS LAN Interface (Summator Interconnection)(RS 485)

Number	2
Connectors	plug connector with screws (up to 255 users)
Users per Segment	16 (32 at loop resistance < 100 Ω)
Operating Mode	multi-master, HDX or FDX
Data Protocol	HDLC/SDLC (adapted to multi-master requirements)
Topology (line and/or open ring)	≤ 1200 m open ring ≤ 100 m bus
Transmission Speed (hamming distance = 4)	62.5 kbps
Status Display	2 LEDs
Matching Resistor	switchable

LON Interface (Connection of Meters)

Number	1 (FTT-10, twisted 2-conductor cable)
Connectors	plug connector with screws (up to 63 users per station)
Operating Mode	LonTalk protocol (CSMA)
Topology	wiring as desired ≤ 500 m bus, terminated ≤ 2700 m (cable type: Belden 85102; Ø 1.3 mm 28 Ω/Km)
Transmission Speed	78 kbps
Status Display	1 LED, LON active
Bus Terminating Element	switchable

Display

Display Element	graphic LCD, 128 x 128 (illuminated)
Format	21 characters 16 lines

Measurement Value Storage

Storage Method	consecutive
Memory Depth	with 1 channel: 128640 entries with 64 channels: 10560 entries
Memory Life Span	with back-up battery ≥ 5 years (see also auxiliary power supply – back-up battery)
Resetting of Meters to Zero	via PC or device keyboard

Time Generator for Date and Clock

Smallest Unit of Time	1 s
Allowable Deviation	10 ppm = 5,3 min/year

Functions Monitoring

Status Display	via LED at front panel
Status Relay	double-throw contacts
Switching Voltage	250 V~, 30 V=
Switching Current	8 A resistive, 3 A inductive
Operating Cycles	≤ 10 ⁵

Influencing Quantities and Influence Errors

Influencing Quantities	Nominal Range of Use	Allowable Influence Error as Percentage of Accuracy Class
Temperature	10 °C ... 22 - 24 ... 40 °C	50%
	0 °C ... 22 - 24 ... 55 °C	100%
Output Load	load range	20%
HF Interference	IEC 255-4 E5 2.5 kV, 200 Ω, 1 MHz, 400 Hz	500%
EM Fields (severity level 3)	IEC 8001-3 10 V/m 27 - 1000 MHz	500%
EMC Burst (severity level 3)	IEC 801-4 2 kV, 5/50 ns, 5 kHz	500%
EMC RF cable (severity level 3)	IEC 801-6 0.15 - 80 MHz, 10 V	200%
Auxiliary Voltage	nominal range of use	10%

Electrical Safety

Protection Class	I
Overvoltage Category	III
Nominal Insulation Voltage:	
Input	50 V
Output: analog, binary, Uv	30 V
Output: relay	250 V
Interfaces	50 V
Auxiliary Voltage, AC	265 V
Auxiliary Voltage, DC	80 V
Interference Suppression EN 55022 (VDE 878.3) Device: Class B	0.15 - 1000 MHz
ESD Protection (IEC 801-2)	4 kV
EMC Surge (severity level 3 (IEC 801-5))	2 kV
Test Voltages:	
Input Housing	0.5 kV
Input/Output	0.5 kV
Auxiliary Voltage Input	3.7 kV
Input Relay	3.7 kV

Resistance to Climatic Conditions

Climatic Category	3z / 70
Relative Humidity	75%
Temperature Range Operation/Function Storage, Transport	-10 °C ... +55 °C -25 °C ... +70 °C

Auxiliary Power Supply

Wide-Range Input, AC - DC	
Nominal Range of Use, AC (45 ... 420 Hz)	85 V ... 264 V
Nominal Range of Use, DC	100 V ... 280 V
Power Consumption	≤ 15 W (25 VA)
Fuse	2 A slow-blow
Direct Voltage Input (optional)	
Nominal Range of Use, DC	20 V ... 72 V
Power Consumption	≤ 15 W
Fuse	2 A slow-blow
Back-Up Battery	
Lithium Cell (replaceable without tools and with no loss of data)	CR 2450
Service Life without Auxiliary Voltage at 20 °C	≥ 5 years
Capacity Loss after 5 Years with Auxiliary Voltage 20 °C	≤ 15%
Supply Voltage for External Circuits	
Voltage Range	direct voltage 24 V ± 4%
Load Capacity	max. 0.15 A
Electrical Isolation	from all other circuits

Mechanical Design

Housing Material	aluminum sheet
Dimensions	212 mm x 125 mm x 85 mm
Mounting Position	as desired
Mounting	to top-hat rail per EN 50022/35 mm or screw mount to plate
Protection	housing: IP 40 terminals: IP 20
Weight	1.6 kg

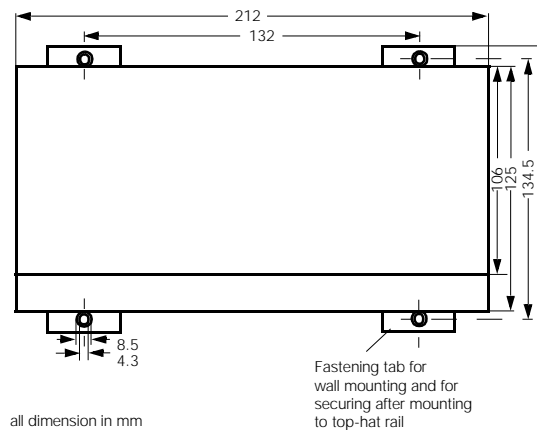


Fig. 2 Dimensions

Mounting the Summator to the Top-Hat Rail

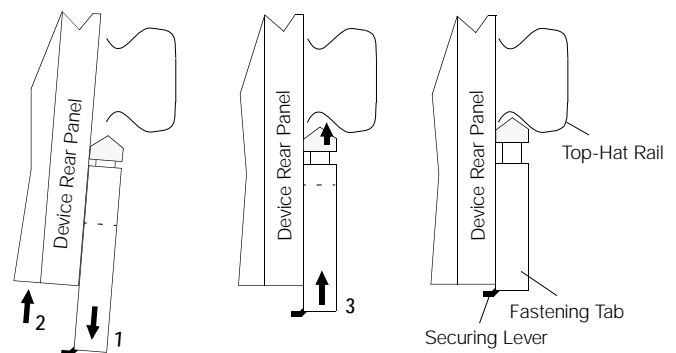


Fig. 3 Opening the Fastening Tabs

Press the securing lever down, and pull the fastening tab out to its last snap-in position. Follow the same procedure for the other fastening tab. Then set the summator onto the top-hat rail and push both fastening tabs all the way in until they snap into position.

Electrical Connection


Signal Cables

Connectors	screw terminals
Allowable Connector Cable Cross-Section	2.5 mm ²

Auxiliary Voltage Cables

Connectors	screw terminals (L and N or + and -)
Allowable Connector Cable Cross-Section	2.5 mm ²
Protective Conductor	6.3 mm cable lug

Terminal Assignments

⊖ Analog / S0												Relay 1			Relay 2			 85...264V AC 45...420Hz AC / DC 20...72V DC											
⊕ E1	⊕ E2	⊕ E3	⊕ E4	⊕ E5	⊕ E6	⊕ E7	⊕ E8	⊕ E9	⊕ E10	⊕ E11	⊕ E12	⎓			⎓														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19	20	21	22	23	24	25	26	27	28	29
⊖ Analog				⊖ S0				Uv		LAN L		LAN R		LON		Status			± U _H ⎓										
⊕ A1	⊕ A2	⊕ S1	⊕ S2	⊕ S3	⊕ S4	⊕ 24V	⊕ EA	⊕ E	⊕ EA	⊕ E	A	B	⎓			L N													
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60



Terminal	Function	Designation
1	input E1	+
2	input E1	-
3	input E2	+
4	input E2	-
5	input E3	+
6	input E3	-
7	input E4	+
8	input E4	-
9	input E5	+
10	input E5	-
11	input E6	+
12	input E6	-
13	input E7	+
14	input E7	-
15	input E8	+
16	input E8	-
17	input E9	+
18	input E9	-
19	input E10	+
20	input E10	-
21	input E11	+
22	input E11	-
23	input E12	+
24	input E12	-
25	relay 1	Ö
26	relay 1	W
27	relay 1	Sch
28	relay 2	Ö
29	relay 2	W
30	relay 2	Sch

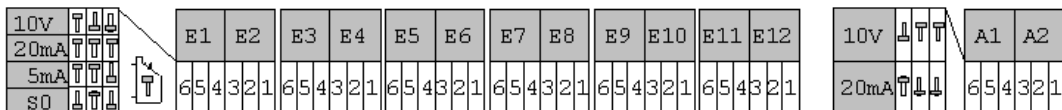
Terminal	Function	Designation
31	output A1 analog	+
32	output A1 analog	-
33	output A2 analog	+
34	output A2 analog	-
35	output S1 binary (S0)	+
36	output S1 binary (S0)	-
37	output S2 binary (S0)	+
38	output S2 binary (S0)	-
39	output S3 binary (S0)	+
40	output S3 binary (S0)	-
41	output S4 binary (S0)	+
42	output S4 binary (S0)	-
43	supply to ext. switching contacts	+ 24 V
44	supply to ext. switching contacts	0 V
45	LAN, Left	EA+
46	LAN, Left	EA-
47	LAN, Left	E+
48	LAN, Left	E-
49	LAN, Right	EA+
50	LAN, Right	EA-
51	LAN, Right	E+
52	LAN, Right	E-
53	LON	A
54	LON	B
55	status relay	Ö
56	status relay	W
57	status relay	Sch
58	auxiliary power supply	L/+
59		
60	auxiliary power supply	N/-

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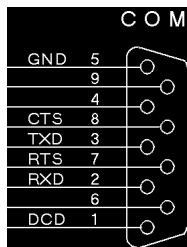
Counting Input and Output Configuration

The analog inputs and outputs can be adapted to the desired measuring range with DIP switches .
Parameter settings for the respective upper range limits are accomplished with the firmware.



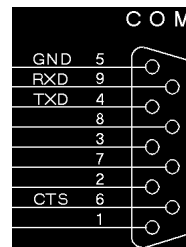
COM1 Pin Assignments for Sub-Min-D9 Plug

Pin Number	Function
1	DCD
2	RXD
3	TXD
4	
5	signal ground
6	
7	RTS
8	CTS
9	



COM2 Pin Assignments for Sub-Min-D9 Plug

Pin Number	Function
1	
2	
3	
4	TXD
5	signal ground
6	CTS
7	
8	
9	RXD



The cable with the designation Z5232 000 R0001 must be used for the connection of a PC or a terminal.

Summator Configuration

Configuration of the U1601 summator is plainly structured. Differentiation is made amongst 5 different configuration groups (see figure 4, SETUP PARAMETERS).

The "general" parameters apply to all of the summators, and thus demonstrate average characteristics, whereas the "channel specific" parameters are directly associated with each individual channel.

The configuration groups "RS 232" and "ECS LAN" apply to the serial interface (RS 232) and the ECS LAN system bus (Energy Control System Local Area Network).

A six character password protects the individual parameters against unauthorized changes.

Basic Configuration

Setup Parameters

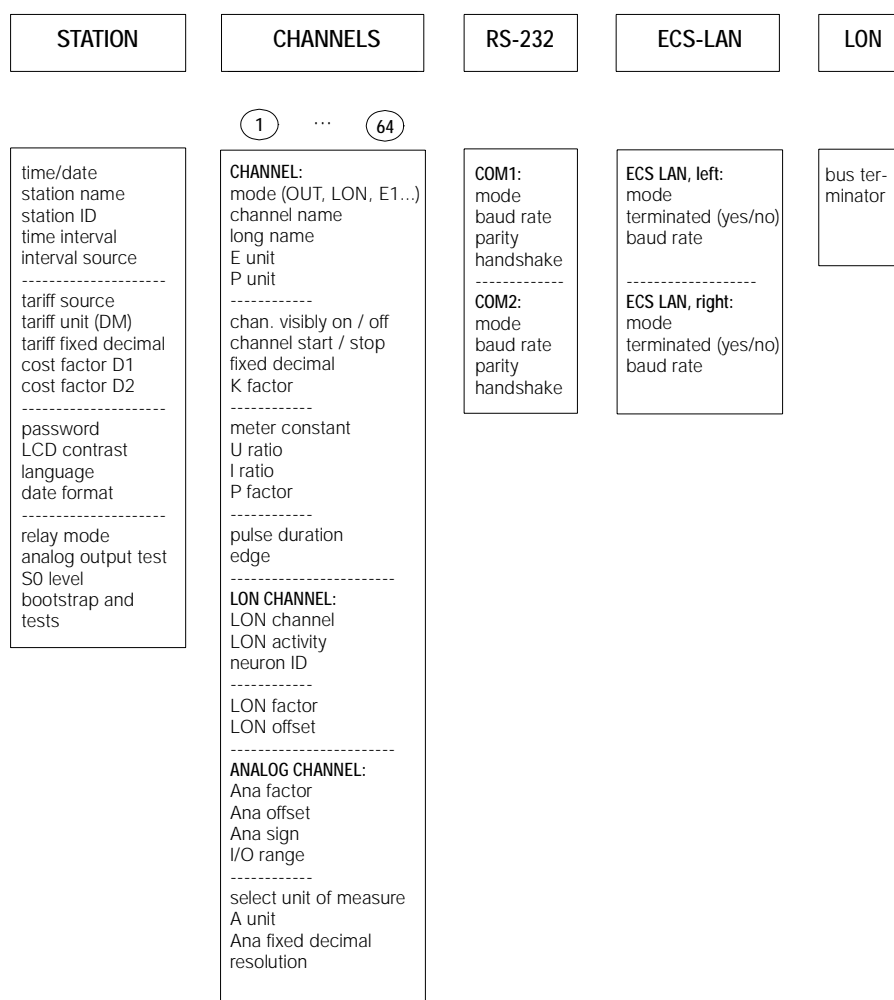


Fig. 4 Setup Parameters

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Network Setup (ECS-LAN)

ECS LAN network topology can be freely selected and can be individually adapted to the existing lines of communication at the installation site.

A network encompasses a maximum of 255 stations, each of which functions as a router and a repeater thanks to the two integrated ECS LAN interfaces. Individual messages are thus only transmitted if the receiver is located within the respective bus segment. Transmission distances from device to device are restricted with the line-to-line structure.

Cable Lengths

The allowable distance between two stations with 2-wire connection is 400 m, and 1.2 km for 4-wire connection. Alternatively, a 2-wire bus system of up to 100 m with a maximum of 16 users can also be implemented. Wiring is accomplished with a twisted pair cable ($\varnothing 0.6 \dots 0.8 \text{ mm}^2$).

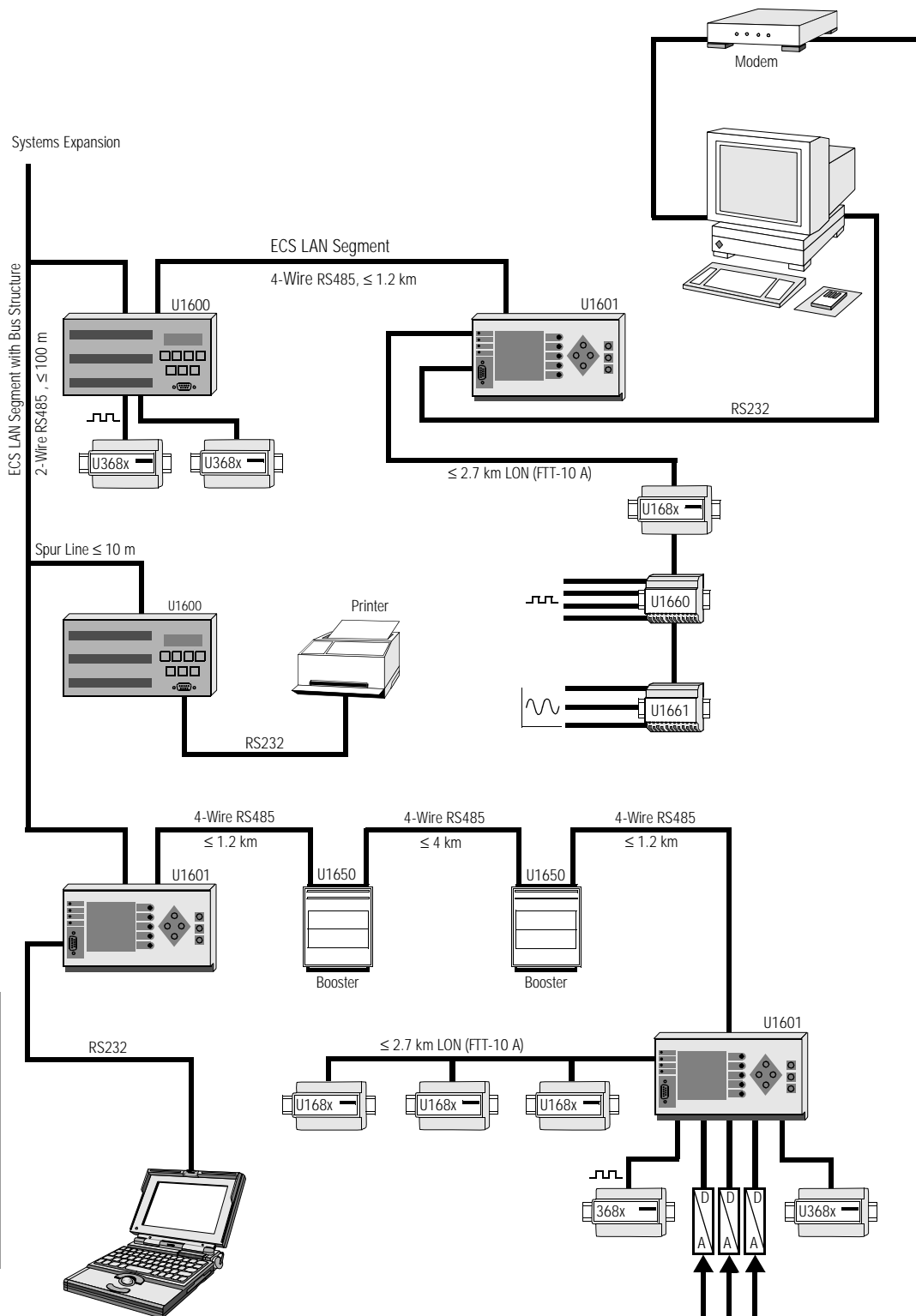
Distances of greater than 1.2 km are linked with RS485 boosters or fiber optic cable. Remote data transmission is accomplished with a modem via public telephone lines.

Detailed wiring instructions are included in the operating instructions.

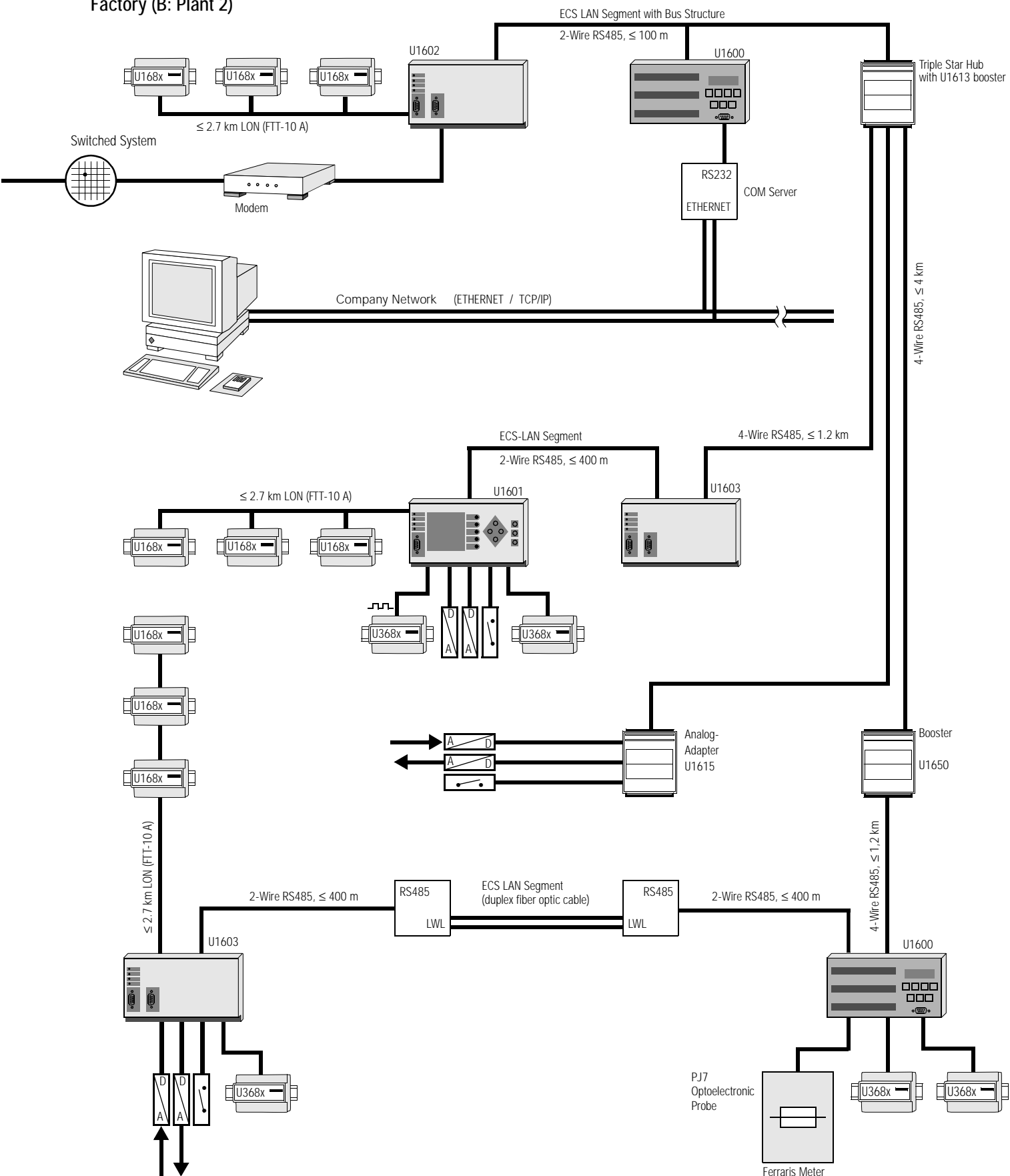
Technical Data, ECS-LAN

Bus Type	LAN (Local Area Network), RS485 electrical interface
Data Protocol	HDLC/SDLC adapted to multi-master requirements
Bus Topology	line, open ring, line and open ring (may be mixed as desired)
Allowable Cable Lengths	1200 m for open ring, 100 m for bus operation
Transmission Speed	62.5 bit/s or 125 kbit/s
Transmission Reliability	hamming distance $d = 4$
Bus Function Status Display	LED

Office Building (A: Plant 1)



Factory (B: Plant 2)



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Order Information

The following applies to the selection of order numbers:

- Only one designation with the same given letter may be selected
- If the upper case letter in the designation is followed by zeros only, the designation need not be included in the order

Description		Designation				
U1601 Summator	with bus connector, serial interface and 12 universal inputs, LON interface	U 1601				
Auxiliary Voltage	AC + DC nominal range of use 85 V ... 264 V DC nominal range of use 20 V ... 72 V	H1 H2				
Operating Instructions and Commands Register	German English French Spanish none	W1 W2 W3 W4 W5				

Order Example

Either the description or the designation can be entered into the order.

Description (clear text)		Designation				
U1601 Summator	with bus connector, serial interface and 12 universal inputs, LON interface	U 1601				
Auxiliary Voltage	DC nominal range of use 20 V ... 72 V	H2				
Operating Instructions and Commands Register	English	W2				

Accessories

Description		Designation				
Connector Cable	for PC or terminal	GTZ 5232 000 R0001				

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GOSSEN-METRAWATT GMBH
Thomas-Mann-Str. 16-20
90471 Nürnberg, Germany
Phone +49 911 8602-0
Fax +49 911 8602-669
e-mail: info@gmc-instruments.com
<http://www.gmc-instruments.com>

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METRAWATT
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