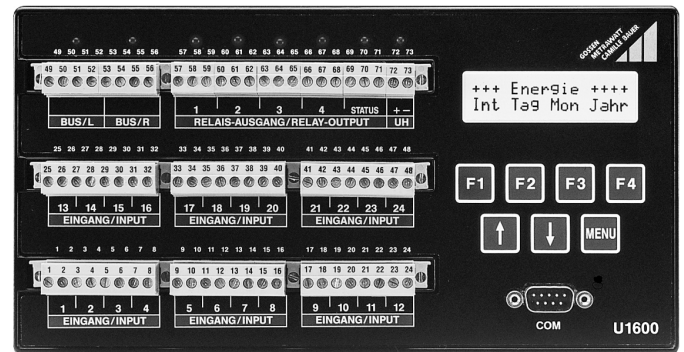


U1600

ECS ENERGY • CONTROL • SYSTEM

3-348-874-03
5/2.00

- 32 processing channels for the determination of energy, power and costs based upon input pulses
- Energy Control Language for analysis programming, monitoring and optimization
- 24 inputs for the processing of SO pulses and digital conditions
- 4 relay outputs for controlling external processes
- Two RS 232 interfaces (19.2 kBit/s) for connecting PC, modem, printer and radio controlled clock
- Two ECS LAN interfaces for interconnection of individual summators over great distances



Applications

The U1600 summator is capable of processing up to 24 pulse signals and digital conditions. All electrical and non-electrical forms of energy can thus be logged, visualized, optimized and billed to individual cost centers.

32 processing channels are available for the 24 input signals. Meter pulses are acquired and summed over defined periods of time at a programmable interval. Energy, power and consumption are determined for each channel, and are processed and saved to memory as load profiles with corresponding maximum values. 8 virtual channels can be used together with arithmetic operations for combination into groups of power consumers, and for subdivision into cost centers.

The U1600 summator is equipped with 4 relay outputs (changeover contacts) for the control of external processes. They can be driven directly from a PC via the interface, or by means of user-specific background programs.

Communication with the PC or remote querying with a modem is accomplished via the RS 232 interface (19.2 kBit/s). Beyond this, a radio controlled clock for system time synchronization or a printer for the generation of reports can be connected as well.

Individual summators can be interconnected over great distances via the multi-master compatible **ECS LAN** with freely selectable network topology, and are provided with unlimited access to data available from all network users.

Thanks to integrated high level intelligence and the customized ECL programming language, the U1600 summator is highly suitable for customer-specific billing, analysis, monitoring and optimization independent of the Energy Control System.

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 EN 50022. It can also be screw mounted or integrated into the control panel. Easy installation is facilitated through the use of plug-in screw terminals.

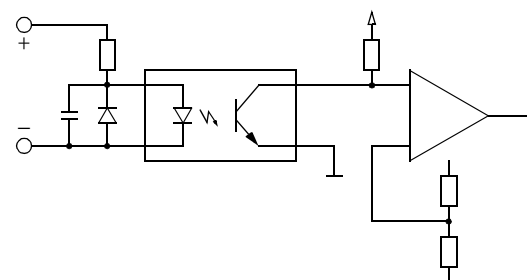


Figure 1, Schematic Diagram, Meter Input

Applicable Regulations and Standards

| | |
|-----------------------------|---|
| VDE 0411, Part 1 / IEC 348 | Regulations for electronic measuring and control devices, part 1, safety measures |
| VDE 0110 | Insulation coordination |
| DIN 40050 | Degrees of protection, protection against particulate and water for electrical equipment |
| EN 55022 | Interference suppression for data processing systems |
| IEC 255-4 | High-frequency disturbance test |
| IEC 801-2 / -3 / -4 | Electromagnetic compatibility |
| DIN 43864 | Current interface for pulse transmission between impulse meters and tariff devices |
| IEC 1036 / VDE 0418, Part 7 | Alternating current, static watt-hour meters for active energy (classes 1 and 2) (points 5 through 5.4 if the corresponding requirements are stricter than those set forth in VDE 0411) |
| VDE 0106, Part 100 | Protection against electrical shock / finger contact safety |

Symbols and their Meanings

| Symbol | Meaning |
|--------|-----------------------------------|
| X | Measured quantity, input quantity |
| Y | Output quantity |
| H | Auxiliary voltage |
| Hn | Auxiliary voltage nominal value |

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, last year and the year before last |
| 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 | the highest value from the current year, last year and the year before last |

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 from the time interval between the last two meter pulses |
| Measuring Interval Mean Values | |
| P int | for all stored measuring intervals (measurement data list) |
| Maximum Mean Value Memory Time with a Measuring Interval of 0.25 Hours | |
| for 1 channel: 113 days | for 18 channels: 17 days |
| for 3 channels: 68 days | for 24 channels: 13 days |
| 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 | the highest value for the current year, last year and the year before last |

Technical Data

Input

| | |
|---|---|
| Input Quantity | direct current (square-wave pulse, SO compatible) |
| Number of Inputs | 24 |
| Allowable Input Quantity Range | signal level: H 4.5 V ... 24 V L 0 V ... 2.0 V |
| Allowable Excessive Input Continuous Intermittent | 48 V 60 V |
| Allowable Switching Elements | semiconductor switches, relays |
| Input Impedance | 5 k Ω |
| Input Wiring | see schematic diagram, figure 1 |
| Electrical Isolation | by means of optocoupler |
| Signal Duration | 10 ms ... 2.55 s |
| Signal Pause | 10 ms |
| Signal Frequency | < 50 Hz |
| Meter Range Upper Limit | 22 places of which 15 are usable |

Display

| | |
|------------------|---|
| Type | LCD (illuminated) |
| Character Height | 5.55 mm (2 lines of 16 characters each) |
| Displayed Data | meter reading, name, power values, costs and other similar data |

Output

| | |
|----------------------|--|
| Binary Output | |
| Switching Elements | relays |
| Number of Relays | 4 |
| Contacts | changeover |
| Switching Capacity | 50 V, 0.5 A |
| Switching Cycles | > 20 x 10 ⁶ at nominal load |

RS 232 Interface

| | |
|-------------------------|--|
| Quantity | 2 |
| Connectors | sub-miniature D9 pin-plug connector |
| Connectable Devices | terminal, printer, PC, modem |
| Number of Data Bits | 8 |
| Data Transmission Speed | COM (1): 19.2 kBit/s COM (2): 19.2 kBit/s |
| Parity | none |
| Operating Mode | full-duplex handshake, Xon / Xoff |

RS 485 Interface

| | |
|---------------------|--|
| Quantity | 2 |
| Connectors | screw-in plug connector |
| Operating Mode | half-duplex or full-duplex |
| Connectable Devices | LAN (local area network) |
| Data Protocol | HDLC / SDLC (adapted to multi-master requirements) |

Measurement Value Storage

| | |
|-----------------------------------|--|
| Storage Method | consecutive |
| Memory Depth | for 32 channels: 10 days for 11 channels: 1 month |
| Memory Life Span | 10 years at 65° C with voltage-free device |
| Resetting Meters Readings to Zero | via PC or device keypad |

Time Generator for Date and Clock

| | |
|-----------------------|-----------------------|
| Smallest Unit of Time | 1 s |
| Allowable Deviation | 10 ppm = 1.8 min/year |

Reference Conditions

| |
|----------------------------|
| In accordance with IEC 688 |
|----------------------------|

Functions Monitoring

| | |
|--------------------|--|
| Status Display | via LED at front panel |
| Status Relay | changeover contact |
| Switching Capacity | 50 V, 0.5 A |
| Switching Cycles | > 20 x 10 ⁶ at nominal load |

Influencing Quantities and Influence Errors

| Influencing Quantity | Nominal Range of Use | Allowable Influence Error |
|----------------------|---|---------------------------|
| Temperature | 0° C ... 55° C | no influence error |
| EM Fields | severity level 2 | no influence error |
| Active Power | pulse frequency \leq 1 Hz \leq 20 Hz | |

Electrical Safety

| | |
|------------------------------|--|
| Safety Class | I |
| Overvoltage Category | III |
| Nominal Insulation Voltage | inputs, outputs, interface connections: 50 V |
| Auxiliary Voltage | 250 V |
| Protection against EM Fields | severity level 2 |
| Surge Withstand Capability | 5 kV, 1.2 / 50 μ s, 0.5 Ws |
| Interference Suppression | class A in accordance with EN 55022 |
| Test Voltages | |
| Input – Housing | 1.5 kV |
| Input – Output | 3.0 kV |
| Auxiliary Voltage – Input | 0.5 kV |

Resistance to Climatic Conditions

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

U1600

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Auxiliary Power Supply

| | |
|---|---------------------------------|
| Alternating Voltage | |
| Nominal Range of Use | 80 V ... 250 V |
| Frequency Range | 45 Hz ... 65 Hz |
| Power Consumption | 19 VA |
| Direct Voltage | |
| Nominal Range of Use | 20 V ... 80 V or 80 V ... 250 V |
| Power Consumption | 15 W |
| Inrush Current | 10 A, 100 ms where H = 48 V |
| Supply Voltage for External Circuits | |
| Voltage Range | 24 V ± 2 V direct voltage |
| Load Capacity | max. 0.4 A |
| Electrical Isolation | from all other circuits |

Mechanical Design

| | |
|-------------------|---|
| Housing Material | die-cast aluminum |
| Dimensions | 240 x 125 x 80 mm |
| Mounting Position | any |
| Mounting | top-hat rail per EN 50022 / 35 mm, or screw mount to plate |
| Protection | housing: IP 40 terminals: IP 20 |
| Weight | 2.3 kg |

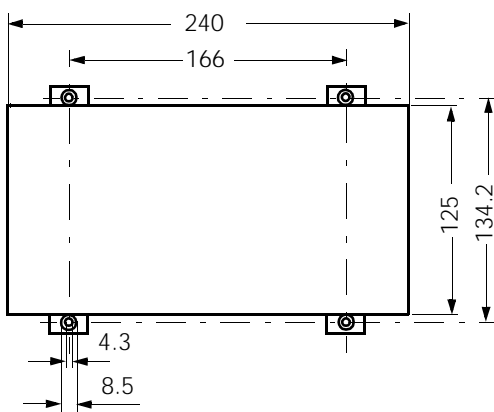


Figure 2, Dimensions

Mounting to Top-Hat Rail

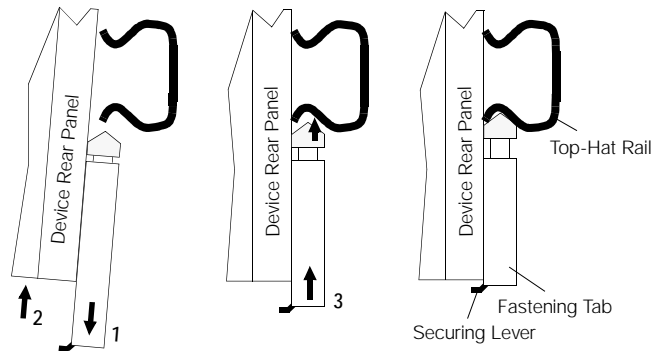


Figure 3, Opening the Fastening Tabs

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 | inlet connector for AC, jack sockets for DC (user retrofit from inlet connector to jack sockets) |
|------------|--|

Terminal Assignments

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|----|-----|----|---------|----|----|----|---------|----|----|----|---------|----|----|----|---------|----|----|----|---------|----|----|----|--------|--|----|
| 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | | |
| +EA | +E | +EA | +E | | | | | | | | | | | | | | | | | | | | | +24V | | |
| Bus / L | | | | Bus / R | | | | Relay 1 | | | | Relay 2 | | | | Relay 3 | | | | Relay 4 | | | | Status | | UH |

| | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|------|------|------|----|----|----|----|-----------------|------|------|------|----|----|----|----|-----------------|------|------|------|----|----|----|----|
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 |
| +E13 | +E14 | +E15 | +E16 | | | | | +E17 | +E18 | +E19 | +E20 | | | | | +E21 | +E22 | +E23 | +E24 | | | | |
| Eingang / Input | | | | | | | | Eingang / Input | | | | | | | | Eingang / Input | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|-----|-----|-----|---|---|---|---|-----------------|-----|-----|-----|----|----|----|----|-----------------|------|------|------|----|----|----|----|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| +E1 | +E2 | +E3 | +E4 | | | | | +E5 | +E6 | +E7 | +E8 | | | | | +E9 | +E10 | +E11 | +E12 | | | | |
| Eingang / Input | | | | | | | | Eingang / Input | | | | | | | | Eingang / Input | | | | | | | |



80 ... 250 V AC
45 ... 65 Hz

20 ... 80 V DC /
80 ... 250 V DC



| Terminal | Function | Designation |
|----------|----------|-------------|
| 1 | Input 1 | + |
| 2 | Input 1 | - |
| 3 | Input 2 | + |
| 4 | Input 2 | - |
| 5 | Input 3 | + |
| 6 | Input 3 | - |
| 7 | Input 4 | + |
| 8 | Input 4 | - |
| 9 | Input 5 | + |
| 10 | Input 5 | - |
| 11 | Input 6 | + |
| 12 | Input 6 | - |
| 13 | Input 7 | + |
| 14 | Input 7 | - |
| 15 | Input 8 | + |
| 16 | Input 8 | - |
| 17 | Input 9 | + |
| 18 | Input 9 | - |
| 19 | Input 10 | + |
| 20 | Input 10 | - |
| 21 | Input 11 | + |
| 22 | Input 11 | - |
| 23 | Input 12 | + |
| 24 | Input 12 | - |
| 25 | Input 13 | + |
| 26 | Input 13 | - |
| 27 | Input 14 | + |
| 28 | Input 14 | - |
| 29 | Input 15 | + |
| 30 | Input 15 | - |
| 31 | Input 16 | + |
| 32 | Input 16 | - |
| 33 | Input 17 | + |
| 34 | Input 17 | - |
| 35 | Input 18 | + |
| 36 | Input 18 | - |
| 37 | Input 19 | + |
| 38 | Input 19 | - |

| Terminal | Function | Designation |
|----------|--------------------|-------------|
| 39 | Input 20 | + |
| 40 | Input 20 | - |
| 41 | Input 21 | + |
| 42 | Input 21 | - |
| 43 | Input 22 | + |
| 44 | Input 22 | - |
| 45 | Input 23 | + |
| 46 | Input 23 | - |
| 47 | Input 24 | + |
| 48 | Input 24 | - |
| 49 | Bus Left | EA + |
| 50 | Bus Left | EA - |
| 51 | Bus Left | E + |
| 52 | Bus Left | E - |
| 53 | Bus Right | EA + |
| 54 | Bus Right | EA - |
| 55 | Bus Right | E + |
| 56 | Bus Right | E - |
| 57 | Relay 1 | 0 |
| 58 | Relay 1 | W |
| 59 | Relay 1 | Sch |
| 60 | Relay 2 | 0 |
| 61 | Relay 2 | W |
| 62 | Relay 2 | Sch |
| 63 | Relay 3 | 0 |
| 64 | Relay 3 | W |
| 65 | Relay 3 | Sch |
| 66 | Relay 4 | 0 |
| 67 | Relay 4 | W |
| 68 | Relay 4 | Sch |
| 69 | Status Relay | 0 |
| 70 | Status Relay | W |
| 71 | Status Relay | Sch |
| 72 | Meter Power Supply | + 24 V |
| 73 | Meter Power Supply | 0 V |

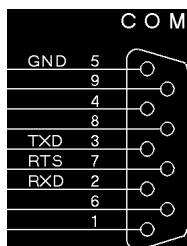
Note: Meter power supply delivers 24 V DC, max. 0.4 A (short-circuit proof)

U1600

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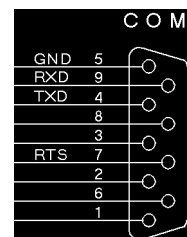
Connector Pin Assignments, Sub-Miniature D9 Plug for COM (1)

| Pin Number | Function |
|------------|---------------|
| 1 | |
| 2 | RXD |
| 3 | TXD |
| 4 | |
| 5 | signal ground |
| 6 | |
| 7 | RTS (+12 V) |
| 8 | |
| 9 | |



Connector Pin Assignments, Sub-Miniature D9 Plug for COM (2)

| Pin Number | Function |
|------------|---------------|
| 1 | |
| 2 | |
| 3 | |
| 4 | TXD |
| 5 | signal ground |
| 6 | |
| 7 | RTS (+12 V) |
| 8 | |
| 9 | RXD |



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

Summator Configuration

Configuration of the U1601 summator is plainly structured. Differentiation is made amongst four 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 Overview

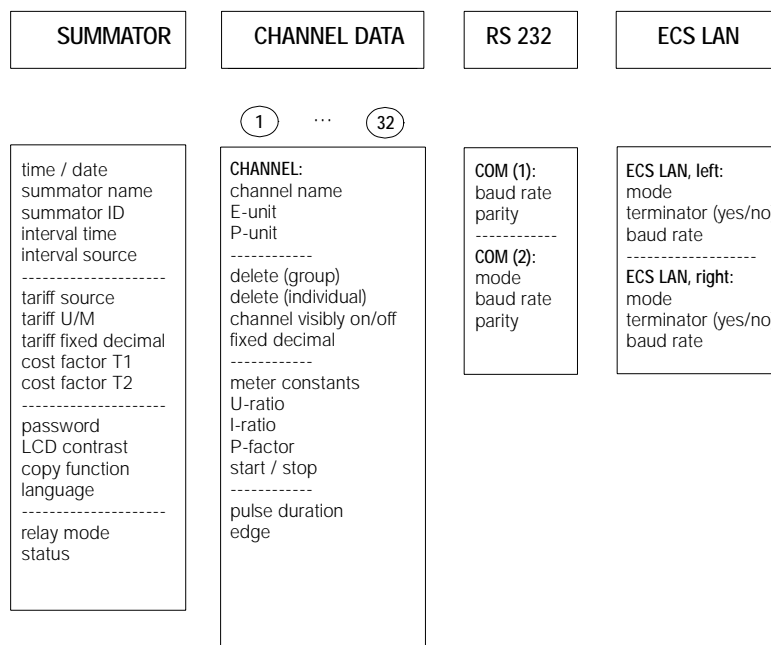


Figure 4, Setup Parameters

U1600

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Network Setup (ECS LAN)

ECS LAN network topology can be freely selected and can thus be individually adapted to 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 forwarded if the receiver is located within the respective bus segment. Transmission distances are measured from device to device if a line-to-line structure is used.

Cable Lengths

The allowable distance between two summators with 2-wire connection is 400 m, and 1.2 km with 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 (0.6 ... 0.8 mm diameter).

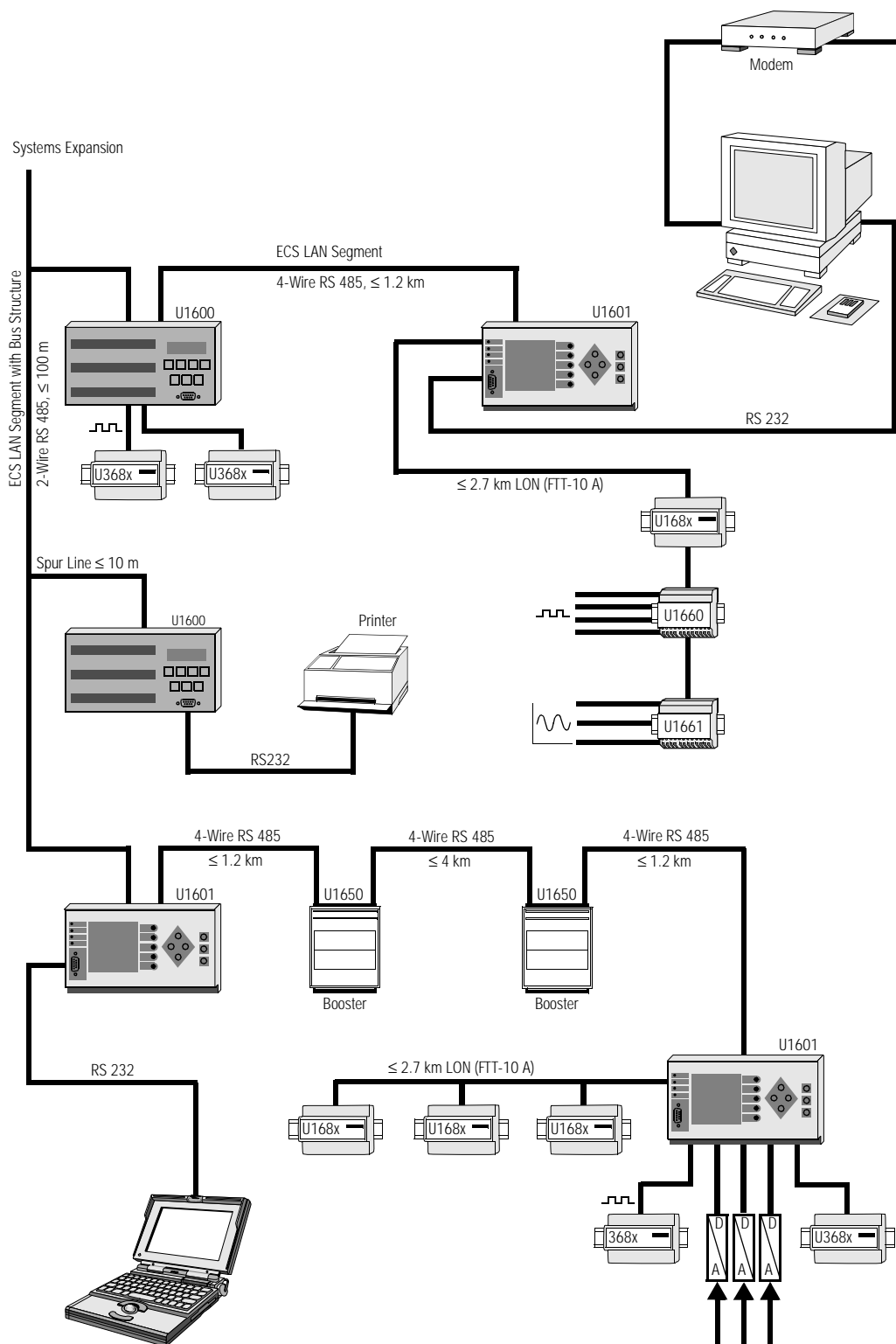
Distances of greater than 1.2 km are made possible with RS 485 boosters or fiber optic cable. Remote data transmission is accomplished with a modem via public telephone lines.

Detailed wiring instructions are included in the operating instructions.

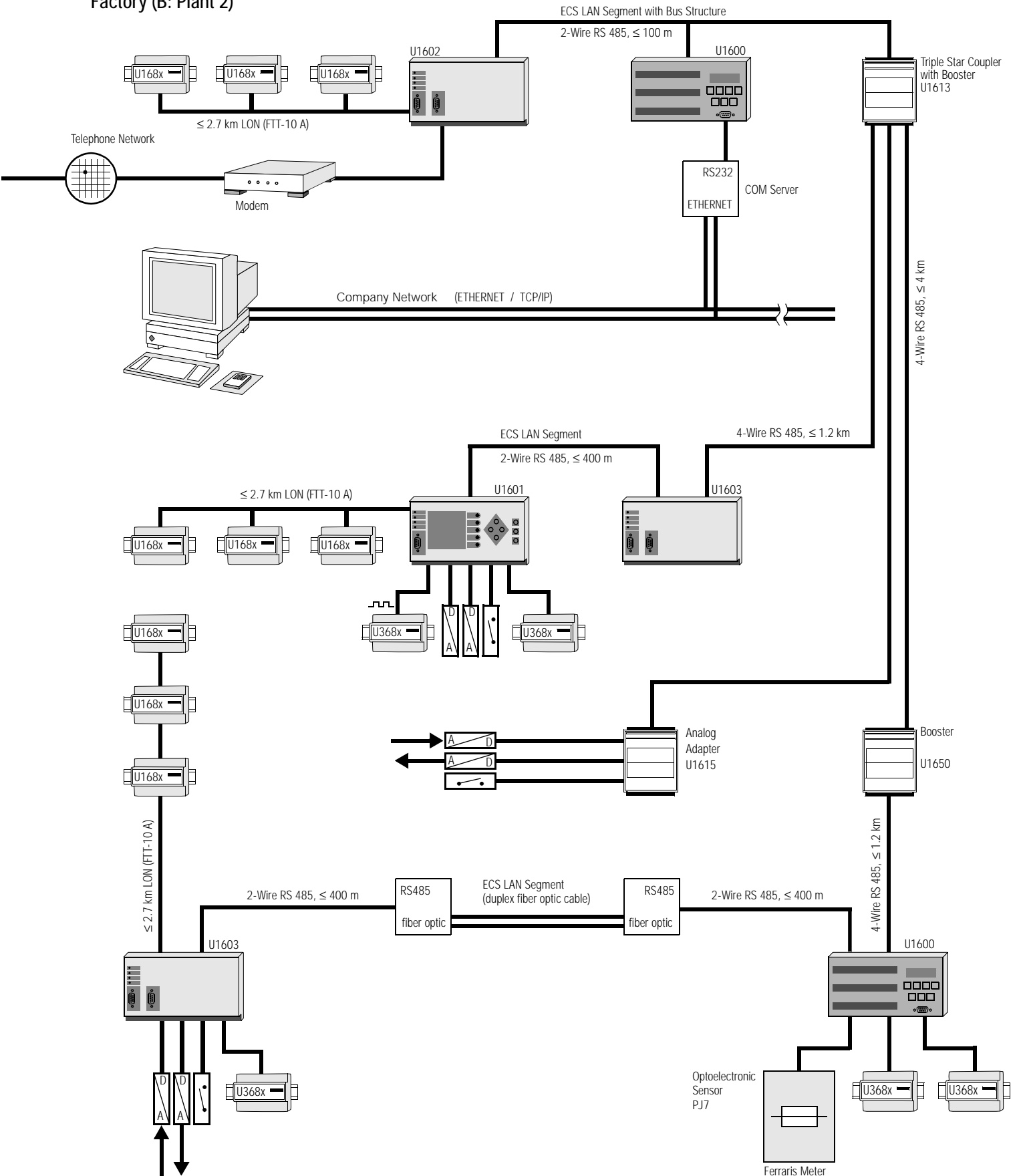
Technical Data, ECS LAN

| | |
|-----------------------------|---|
| Bus Type | LAN (local area network), RS 485 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 kBit/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)



U1600

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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 | | | | |
|--------------------------------|--|-------------|--|--|--|--|
| U1600 Summator | with bus connection, serial interface and 24 meter inputs | GTU 1600 | | | | |
| Auxiliary Voltage | AC + DC nominal range of use: 80 V ... 250 V DC nominal range of use: 20 V ... 80 V | H1 H2 | | | | |
| Language for Menus | German English | S1 S2 | | | | |
| Additional Text on Serial Pate | with without | Z1 Z0 | | | | |
| Expanded Memory | with without | E1 E0 | | | | |

Order Example

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

| Description (enter in clear text) | | Designation | | | | |
|-----------------------------------|---|-------------|--|--|--|--|
| U1600 Summator | with bus connection, serial interface and 24 meter inputs | GTU 1600 | | | | |
| Auxiliary Voltage | DC nominal range of use: 20 V ... 80 V | H2 | | | | |
| Language for Menus | German | S1 | | | | |

Accessories

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

U1600

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