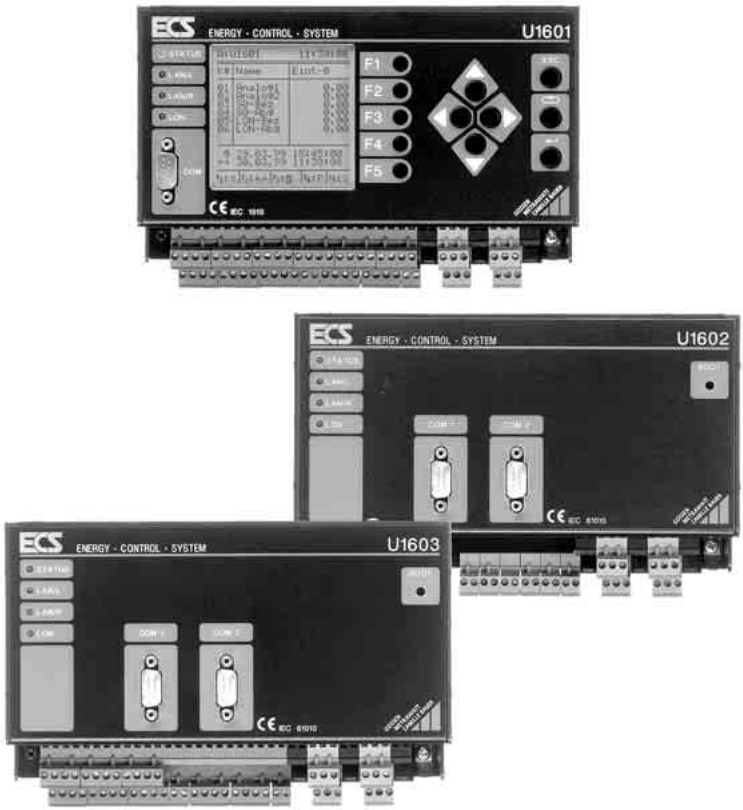
Operating Instructions

GOSSEN METRAWATT

U1601, U1602, U1603

Energy Control System ECS

3-348-869-03
3/11.02



Device Overview

	U1601	U1602	U1603
64 channels	✔	✔	✔
Analog inputs / S0	I1 ... I12	—	I1 ... I6
Binary outputs	S1 ... S4	—	S1 ... S4
Analog outputs	01, 02,	—	01, 02,
Relay outputs	Relay 1, relay 2, status	Relay 1, relay 2, status	Relay 1, relay 2, status
RS 232 COM1 / COM2	✔ (in a single plug)	✔	✔
LANL / LANR	✔	✔	✔
LON	✔	✔	✔
24 V auxiliary power	✔	✔	✔
Control panel	✔	—	—

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1 Applications

The **E**nergy **C**ontrol **S**ystem (**ECS**) allows for unambiguous cost center accounting. Electrical as well as non-electrical energy and its consumption can be recorded, optimized and billed to individual cost centers.
The U1601, U1602 and U1603 summators are at the heart of the Energy Control System (ECS) and enable the recording and billing of both analog and digital quantities.

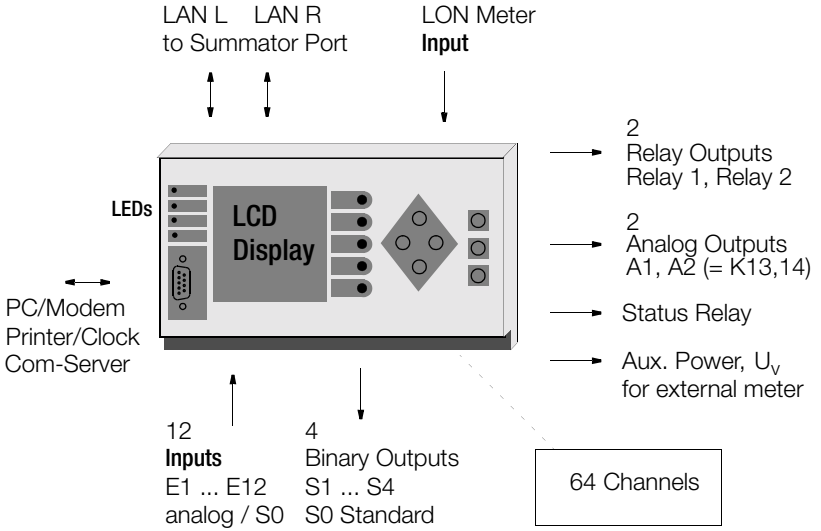
ECS operating software revision level: V2.47
LON® is a registered trade mark of the Echelon Corporation.

2 System Description

- **Analog signals** from orifice plates, measuring transducers or other measuring instruments are acquired, analyzed and stored together with **meter pulses** from energy meters, flow meters and heat meters at the intelligent U1601 summator.
- Each summator can be connected to up to **12 energy meters** with pulse output. Data collected at the meter inputs are integrated and stored according to various criteria to a semiconductor memory with battery back-up.
- **64 channels** are available for the generation of sums and/or differences based upon meter values. Values from other summators which are connected to the ECS LAN can be used to generate virtual channels as well. All of the stored measurement values can be displayed at the summator.
- Stored values can be read out from the U1601 summator with a **PC**, or can be remote queried with the help of a **modem**. A **radio-controlled clock** for correct time synchronization or a **printer** for the generation of reports can be connected to the second RS232 interface.
- Several summators can be linked to one another via the **ECS LAN**, a multi-master compatible RS485 field bus, for applications which required the use of more than 12 inputs (analog/binary). The linking of up to 255 summators from 16xx series instruments via the ECS LAN allows for the establishment of a powerful energy control system, which is controlled and monitored with a PC.
- All of the instruments connected to the bus can be queried and programmed from any desired summator thanks to the **multi-master system structure**. A limit value violation at summator M can thus trigger a signal at summator N. Each bus user has access to all data and functions throughout the entire system.
- **LON** is a new type of intelligent bus concept with allows controllers, sensors and actuators to communicate with one another. In addition, up to 63 nodes can be connected to a U1601 summator via the integrated LON network.
- Two freely programmable **relays** allow for the generation of messages or the triggering of specific actions if certain criteria have been fulfilled.
- User generated programs can be installed to the summators through the use of the system-specific **programming language**, Energy Control Language (ECL). The summators can thus be adapted to **customer-specific** calculations, analyses, monitoring and optimization independent of the energy control system.
- **ECSwin PC software** for configuring parameters at the summators, and for reading in energy consumption data and displaying them in tabular and graphic form.

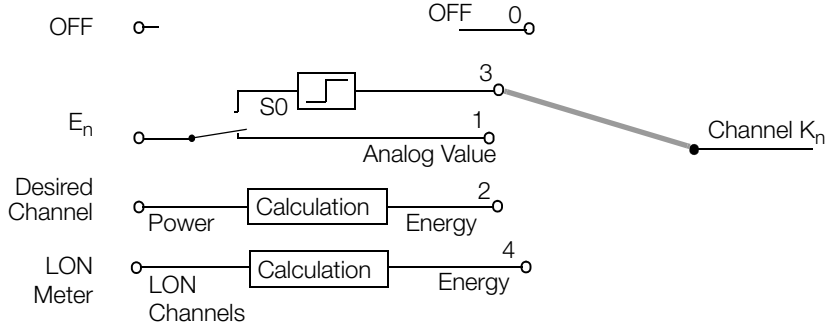
3 Instrument Description

3.1 Instrument Overview



3.2 Channels / Calculations

64 software channels are available. The input type for each channel can be selected for the basic configuration with the CMODE channel parameter (0 ... 4).



Cyclical Generation of Channel Registers

Due to the fact that many various energy data registers are made available to each channel (33 registers without maximum values: Etot, EtotT1, EtotT2, Pmom, 10+1 times Eday, 12+1 times Emon, 4+1 times Eyear), only the most important summations are performed continuously, and less important summations are performed in accordance with a rotating schedule. For example, Etot is calculated continuously, whereby Emon-12 is determined less frequently (approximately every 30 to 90 seconds). Power values, except for Pmom, are continuously calculated based upon energy values, and thus need not be summated.

Channel Names

A name can be assigned to each channel with a length of up to 8 characters. These names allow for improved channel identification during data processing, as well as for graphic representations. **System-wide** access to a given channel is also enabled through the use of such names.

```
<A> Etot Motor5
```

A system-wide search for a channel with the name “Motor5” is performed from summator A, and total energy from this channel is graphically displayed (see also ECL command: FINDER).

Channel Numbers

If inputs (E1 ... E12) are to be assigned to the channels, each input can only be assigned to the channel which bears the same number, i.e.:

- Inputs E1 ... E12: Channels K1 ... K12

Virtual Channels

- Any unused channel can be utilized as a virtual channel for the generation of any desired sums or differences which result from physical inputs or other virtual channels. It makes no difference which summators within the ECS LAN the channels have been assigned to!
- Unused physical channels can also be utilized as virtual channels, in which case even the maximum value registers for the corresponding physical channel are made available.
- The synchronizing-interval data logger can record data from virtual channels.

Differential Linking (ECL commands dVSUM and dVIRT)

As soon as they have been defined, incoming energy quantities (~ meter pulses) from the source channels are continuously summed and the summed energy quantities are fed to the virtual channel, “as if they had actually just been measured”. The virtual channel is decoupled from the source channels and data can be manipulated as desired.
Areas of application: logical coupling of input signals (as if the corresponding input signals had been switched together to a single channel).

Example 1:

Channel 26 at summator D generates a cost center based upon channels 1 ... 5+8 from summator B weighted with a factor of 0.7, and channel 4 from summator C weighted with a factor of 0.3

```
H1='B:dVSUM 1..5+8 0.7, C:dVSUM 4 0.3, D:dVIRT 26='
```

Example 2:

Channel 10 is the difference between 1 ... 8 and total-sum channel 9
(sum of 1 ... 8 minus channel 9):

```
H2='dVSUM 1..8, dVSUM 9 -1, dVIRT 10='
```

Channel Parameters (chapter 6.4, page 34)

Numbers Range

In order to ensure greatest possible accuracy, all internal calculation operations are performed with 64 bit floating decimal point numbers. This means that 15 (!) significant decimal places are possible.

Switching the Channel Display On and Off

The On/Off function only determines whether or not a channel is visible while browsing through channel data at the display, or during read-out with '*****' (ECL command: ONOFF). The function of the channel remains otherwise entirely unaffected.

Channel Start/Stop

The Start/Stop function is used to determine whether or not meter pulses are to be accepted at a given input (ECL command: STARTSTOP).

- A virtual channel which has been generated by means of “differential linking” can be influenced with the Start/Stop function in an analog fashion.
- Since the binary input status of a channel is not influenced, this function can be used, for example, to avoid taking undesired binary data into consideration.

Energy Metering

Meter pulses filtered out in this fashion are integrated, per channel, into a temporary meter. The meter values are converted into their corresponding energy values every 1 to 2 seconds, and are added to total energy registers. Pulses are converted to energy values by means of the following formula:

Energy Calculation

$$\text{Energy[kWh]} = \frac{\text{Pulses[Imp]}}{\text{MeterConstant}\left[\frac{\text{Imp}}{\text{kWh}}\right]} \times U_{ratio} \times I_{ratio} \times \text{KFactor}$$

where:

$$U_{ratio} = \frac{U_{primary}}{U_{secondary}} \qquad I_{ratio} = \frac{I_{primary}}{I_{secondary}}$$

Power Calculation

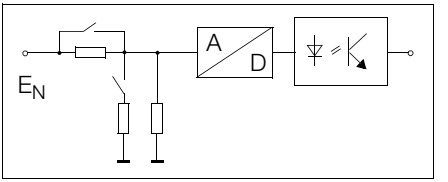
Instantaneous power, PMOM, is determined based upon the interval between the incoming pulses. All other power values are calculated from the corresponding energy value, taking the corresponding time interval into consideration.
The calculation of power assumes the assignment of an energy unit of measure **per hour** (kWh). The power factor must be adapted accordingly for other units of measure (e.g. liters per minute) (ECL command: PFACTOR). The default value is 3600, and it would be 60 for the “liters per minute” example.
Formula for the calculation of power based upon energy E and duration dt:
P = E * Pfactor / dt
Only sensors which have been connected via the LON network are capable of transmitting already calculated power and energy values to the summators.

3.3 Inputs E1 ... E12 (analog / binary)

Analog Inputs

12 optically isolated analog inputs are available, E1 ... E12. These can be configured as voltage, current or binary inputs. See page 52 and page 34 for DIP switch settings and appropriate software settings.
One metering channel, 1 ... 12, can be assigned to each of the inputs, E1 ... E12.
The applied analog input value may correspond to a measured power quantity.
The input ranges (20 mA, 5 mA, 10 V, S0) must be pre-selected with the DIP switches, as well as the I/O RANGE parameter. Energy is matched to the various ranges, and calculated and recorded as a channel quantity with the configurable ANAFACTOR and ANAOFFSET parameters.

Binary Meter Inputs



The 12 analog inputs, E1 ... E12, can also be used as binary inputs (in accordance with the S0 standard). Configuration is accomplished by means of DIP switches and software (see page 52 and page 34). A binary input recognizes two different levels, high level “1” and low level “0” (max. low level adjustable with ECL command: LEVEL). Thus switching back and forth between tariffs T1 and T2 can be performed with input 12. The synchronization pulse from the electric utility can also be connected, for example, to input 11. Status can be queried via software with the ECL command INPUT.

Debouncing Time and Trigger Edge

Debouncing time and the trigger edge can be configured individually for each of the 12 channels. Sampling time for all 12 channels amounts to 5 ms.

- Debouncing time is adjustable from 10 ms to 2.55 s in 10 ms steps, ECL command: PULSE
- High level trigger flank (1): Triggering occurs for change from low level to high level, ECL command: EDGE
- Low level trigger edge (0): Triggering occurs for change from high level to low level.

If an input is used as a binary input, the selected debouncing time applies to this operating mode as well. For example, if debouncing time has been set to 1 s, only those signals are processed which remain stable at either high or low level for at least 1 second. Only debounced signals appear at the input status display at the control panel as well.

3.4 Analog Outputs A1 and A2

Two configurable analog outputs can be driven with the ECL command ANA. The output quantity (20 mA or 10 V range) must be selected with the DIP switches and the I/O RANGE parameter (see page 52 and page 39).
Input channels can be recorded, scaled and read out continuously as transduced quantities with the help of a background program (see also ECL command: ANA 13, ANA14).

3.5 S0 Outputs S1 through S4

Just like the relay outputs, four freely programmable S0 outputs allow for the forwarding of messages when certain conditions have been fulfilled. Selectable voltage is limited to 50 V. Additionally, these outputs can be used as floating pulse outputs for the

transmission of meter readings to remote locations with the help of ECL background programs (see ECL command: S0REL 1 ... 4).

3.6 Relay Outputs

Two freely programmable relays (changeover contacts) allow for the generation of a message or the triggering of an action, if certain criteria have been fulfilled. For example, a relay output can be activated if the mean power value within the synchronization interval exceeds a certain value. The current relay status is displayed at the LCD under summator status. A ★ indicates that the contact is closed and active. Please observe the characteristic values in the appendix.

Relay Names

A channel name can be assigned to each of the relays and may have a length of up to 8 characters. This name allows for improved relay identification during data processing, as well as for graphic representations. **System-wide** access to a given relay is also enabled through the use of such names:

```
<A> REL Horn=1
```

A system wide search for a relay with the name “Horn” is performed from summator A, and this relay is activated (see also ECL command: FINDER).

3.7 Self Test

As long as the electronics are functional and no system error has been detected, the status LED and the status relay are on. If the instrument electronics malfunction, the relay is released and the LED goes out. A horn which can be driven with the status relay’s break contact can be used to indicate a malfunction.
The current relay status is displayed in the status window (see chapter 5.8, page 26). Functional testing can be expanded by means of appropriate programming (ECL command: STATCHECK, see detailed information in online help: ? STATCHECK). For example, the output can be deactivated (error condition) as soon as the 24 V power supply drops to below 16 V, or if the condition of the lithium battery no longer allows for reliable data storage. Testing of the lithium battery only occurs immediately after the instrument has been switched on.

3.8 RS232 Interface

Communications with a host computer (PC), a terminal, a modem or a printer is made possible via the RS232 serial interface.

Access to All Measurement Data

A PC which has been connected to the RS232 interface has full access to all stored system measurement values. **ECS*win*** parameters configuring software, which runs on the PC, manages all ECS data and allows for tabular data analysis.

Port Configuration

The RS232 port is configured in the DTE format (data terminal equipment), and signals are conducted by a 9-pin D-SUB plug. The DTE configuration is compatible with standard PC and terminal configurations. Wiring of the connector cable is described in chapter 7.3, page 52.

3.9 ECS LAN

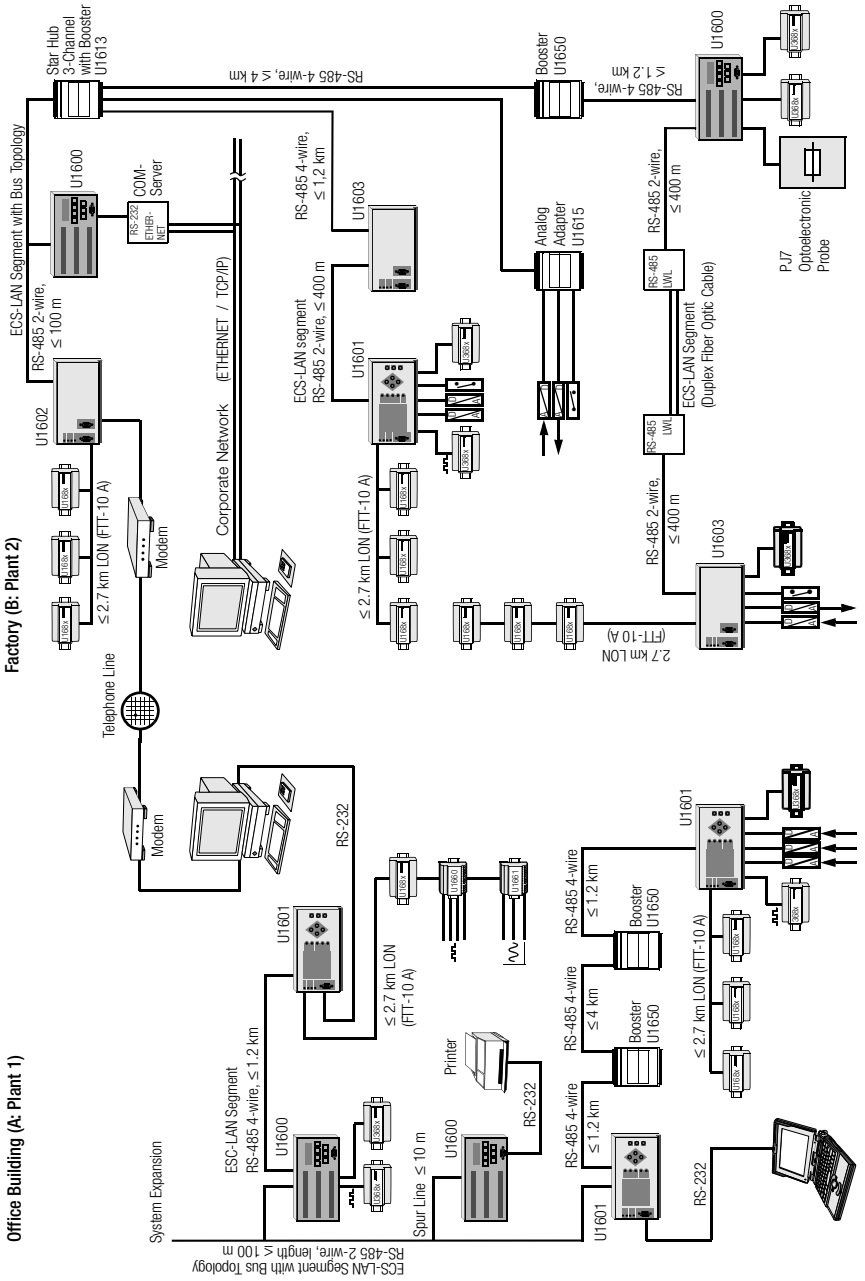
Several summators can be linked to one another via a multi-master compatible RS485 field bus (ECS LAN) for applications which require the use of more than 64 channels. The connection can be established by means of a 2-wire cable using either bus or a line topology. The maximum length per segment is1200 meters. Distances of several kilometers between 2 summators can be accommodated with fiber optic transmission and
4-wire technology.
A maximum of 255 summators can be connected to the ECS LAN. This means that a maximum distance of approximately 300 km can be covered without additional boosters.

Multi-Master System Architecture

The most significant advantage of the multi-master system architecture is the fact that each of the bus users has full access to all of the data and functions encompassed by the overall system. It is thus unnecessary to assign the designation of bus master a single summator.

General Notes Concerning the ECS LAN

- The **connector technology** for the individual LAN segments can be freely selected and combined.
- The longest cable length is determined by the **transmission speed** in accordance with RS485. The ECS LAN normally runs at 62.5 KBaud, which corresponds to a maximum cable length of 1.2 km.
- The transmission cable must be terminated at both ends (and only at the ends) with **matching resistors**. The matching resistors are integrated and can be switched on or off at the control panel. Correct functioning of the 2-wire connection can only be secured through the use of these integrated matching resistors. No external resistors may be used!
- The **loop resistance** of the transmission cable may not exceed 100 Ohms in 2-wire operation.
- Up to **16 summators** can be connected to a single bus segment. If the matching resistors have been correctly installed (see above), if spur line lengths have been minimized and if the overall loop resistance of the transmission cable is less than 100 Ohms, up to 32 summators can be operated within a single segment.
- **User statistics** can be queried via the control panel (instrument status).


Factory (B: Plant 2)
Office Building (A: Plant 1)
Star Hub 3-Channel with Booster U1613
RS-485 4-wire, ≤ 4 km
Booster U1650
RS-485 4-wire, ≤ 1.2 km
U1600
ECS-LAN Segment with Bus Topology
RS-485 2-wire, ≤ 100 m
COM-Server
RS-232
ETHER-NET
(ETHERNET / TCP/IP)
Corporate Network
RS-485 4-wire, ≤ 1.2 km
U1603
ECS-LAN segment RS-485 2-wire, ≤ 400 m
U1601
Analog Adapter U1615
RS-485 2-wire, ≤ 400 m
RS-485 LWL
ECS-LAN Segment (Duplex Fiber Optic Cable)
PJ7 Optoelectronic Probe
U1602
≤ 2.7 km LON (FTT-10 A)
Modem
Telephone Line
≤ 2.7 km LON (FTT-10 A)
2.7 km LON (FTT-10 A)
RS-232
ESC-LAN Segment RS-485 4-wire, ≤ 1.2 km
System Expansion
Spur Line ≤ 10 m
Printer
RS-485 4-wire ≤ 4 km
RS-485 4-wire ≤ 1.2 km
ECS-LAN Segment with Bus Topology RS-485 2-wire, length ≤ 100 m

Bus Left, Bus Right

Each summator is equipped with 2 complete ECS LAN interfaces. They are designated as LAN L and LAN R. Each of these interfaces can be operated with either 2-wire or 4-wire transmission technology (RS485).

2-Wire

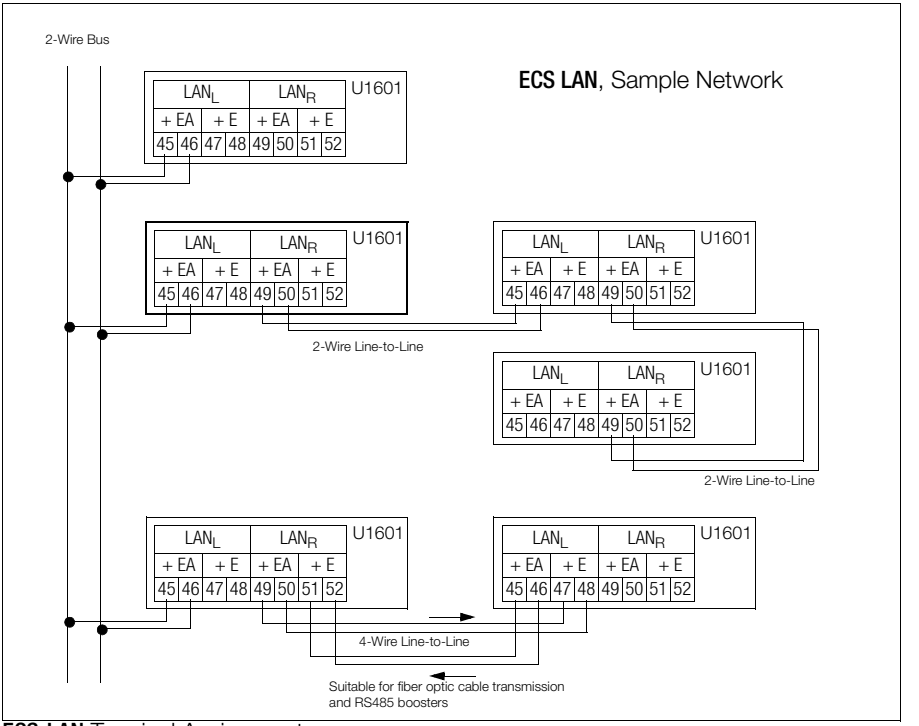
A bus system, by means of which several summators are connected to the same bus cable, must be laid out with 2-wire technology.

4-Wire

4-wire technology is used where unusually long transmission paths are involved, or when boosters need to be integrated into the system. In such cases only line-to-line connection is possible.

Cable Lengths

If several summators (up to 16) are to be installed in close proximity to one another (overall maximum bus cable length of 100 m), a bus connection making use of a twisted, two conductor cable is recommended. A line-to-line connection with a twisted four conductor cable is not necessary until the distance between 2 summators is greater than 400 m (max. 1200 m).



ECS-LAN Terminal Assignments

User Directory

Directory of ECS LAN Users

Each summator automatically generates an internal directory (ECL command: DIR) of all users connected to the ECS LAN (assuming that unique identification has been assigned throughout the entire system). Each summator acknowledges its presence to

the entire system every 3 seconds with a so-called broadcast message, and all receiving summators update their internal directories accordingly. If no message is broadcast for a period of greater than 20 seconds, the summator in question is deleted from the internal directories of the other summators.

Unique Identification

Each summator within the ECS LAN must be assigned its own **unique** summator identification. Up to 255 different, freely selectable identifications can be created. The following format is used: A, A1 .. A9, B, B1 .. B9, .. , Z, Z1 .. Z4

System-Wide Access to Measurement Data

Example: Total energy from channel 1 at summator **D1** is to be queried from summator **A**:

```
<A> D1:Etot 1
```

3.10 LAN LED (LANL/LANR)

One LED each for bus left and bus right indicates correct operation of the ECS LAN:

- If no ECS LAN users have been connected, the LED does not light up.
- If one or more users are connected to the corresponding bus segment, the LED lights up.
- If two or more users have the same identification, the LAN LEDs which represent the users with identical identification blink. Exception: If the summators with identical identification are connected to the same LAN segment, no decisive error message occurs. For this reason, the number of summators should always be compared with the total number indicated in the user statistics (control panel, instrument status) during instrument installation.
- If the internal matching resistor has not been switched on during bus operation, the corresponding LAN LED blinks.

3.11 LON Connection

LON is a relatively new type of intelligent bus concept which allows control units, sensors and actuators to communicate with one another. Rapid, cost-effective wiring is achieved by means of intelligent decentralization. Each node (user) is equipped with a neuron chip, and can communicate with all of the other nodes via the LON-Talk protocol. Data transmission is accomplished with a standardized, twisted, potential-free two conductor cable, which can be wired either in bus, ring or star configuration (freely selectable topology!). The electrically isolating FTT10 transceiver used to this end is protected against polarity reversal and transmits data at a speed of 78 kb per second. Thus up to 63 additional nodes can be connected to a U1601 summator via the integrated LON network. During the first phase of completion, bus users include LON compatible bus meters, as well as input/output modules, gas or water meters etc. at later stages.
Energy values from the LON meters can be freely assigned to channels K1 ... K64 by means of differential linking.

3.12 LON LED

LON LED off	All LON channels deactivated (page 34)
Blinking LON LED	Error in communication with LON users
LON LED on	LON bus OK

4 Measurement Data

4.1 Overview of Available Measurement Data

The following measurement data are available for each meter input and virtual channel:

Energy Values (cumulative as of a defined starting point)

Etot	Total energy, independent of tariff
EtotT1	Total energy for tariff T1
EtotT2	Total energy for tariff T2
EtotT1+T2	Total energy for tariffs T1 plus T2

Energy Values (cumulative for defined time periods)

EInt	EInt-1	...	EInt-10	Cumulative energy for the current, and the last 10 intervals (data logger)
Eday	Eday-1	...	Eday-10	Cumulative energy for the current, and the last 10 days
Emon	EMon-1	...	EMon-12	Cumulative energy for the current, and the last 12 months
Eyear	Eyear-1	...	Eyear-4	Cumulative energy for the current, and the last 4 years

Maximum Values from Synchronization-Interval Measurement Data (with date and time)

EMax	EMax-1	...	EMax-10	The 10 highest values
EMaxDay	EMaxDay-1	...	EMaxDay-10	Maximum energy value for the current, and the last 10 days
EMaxMon	EMaxMon-1	...	EMaxMon-12	Maximum energy value for the current, and the last 12 months
EMaxYear	EMaxYear-1	...	EMaxYear-4	Maximum energy value for the current, and the last 4 years

Costs (cumulative as of a defined starting point)

CostT1	Costs for tariff T1
CostT2	Costs for tariff T2
CostT1+T2	Costs for tariffs T1 plus T2

Power Values (mean values for defined time periods)

Pmom				Instantaneous power between the last 2 meter pulses
PInt	PInt-1	...	PInt-10	Power for the current, and the last 10 intervals (data logger)
PDay	PDay-1	...	PDay-10	Mean power value for the current, and the last 10 days

PMon	PMon-1	...	PMon-12	Mean power value for the current, and the last 12 months
Pyear	Pyear-1	...	Pyear-4	Mean power value for the current, and the last 4 years

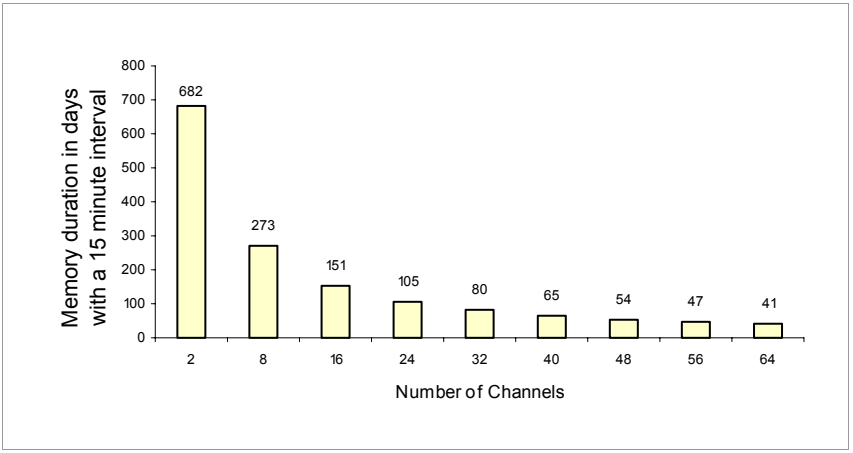
Maximum Values from Synchronization-Interval Measurement Data (with date and time)

PMax	PMax-1	...	PMax-10	10 highest values from all meas. intervals
PMaxDay	PMaxDay-1		PMaxDay-10	Maximum power value for the current, and the last 10 days
PMaxMon	PMaxMon-1	...	PMaxMon-12	Maximum power value for the current, and the last 12 months
PMaxYear	PMaxYear-1	...	PMaxYear-4	Maximum power value for the current, and the last 4 years

Summary of Available Measurement Data per Channel

Energy Values	Power Values	Max. Energy Values	Max. Power Values	Costs
Etot	Pmom			
EtotT1				CostT1
EtotT2				CostT2
EtotT1T2				CostT1T2
Eint	Pint	Emax	Pmax	
Eday	PDay	EmaxDay	PMaxDay	
EMon	PMon	EmaxMon	PmaxMon	
Eyear	Pyear	EmaxYear	PmaxYear	

Relationship between Memory Duration and Number of Channels
for Synchronization-Interval Measurement Data (measurement data list, format: 0 … 3):



Memory Duration as a Function of Number of Channels I

Number of Channels	Number of Records	Memory Duration in Days with a 15 minute interval
2	65535	682
8	26214	273
16	14563	151
24	10082	105
32	7710	80
40	6241	65
48	5242	54
56	4519	47
64	3971	41

4.2 Synchronizing-Interval Data Logger

The energy values which have been measured during a given interval can be stored to a data logger. This interval (duration: 10 s .. 999 hr., default: 15 minutes) is either derived from system time, or the interval limit is determined with a trigger pulse slope (default: channel 11). Energy measured during this interval (EINT) is entered into a list along with the time and the date. The mean power value occurring within the interval (PINT) is calculated based upon EINT and the duration of the corresponding interval.

Formatting the Data Logger

Attention!
The contents of the data logger are deleted during formatting.

The number of records in the data logger depends upon the number of channels. Thus the data logger can be formatted in accordance with the desired number of channels. Formatting can only be performed with an interpreter. Data area resolution is also defined simultaneously (ECL command: FORMAT).

Defining the Number of Records

The format command reserves adequate space for the selected number of channels in system memory. The greatest possible number of records is thus determined, but not memory duration which is solely dependent upon the duration of the interval.
Example: Only channels 1 ... 4, channel 17 and channels 21 .. 23 are to be recorded to the data logger.

```
<A> FORMAT=1..4+17+21..23
```

If the format command is called up without parameters, status information is read out to the data logger. Most importantly, the number of records which can be entered to the data logger is shown here.

<A> FORMAT = 1...4 + 17 + 21 ... 23
<A> format
Format(0): 8 channels, 26214 records (= 273 days, with a 15 min. interval)
Channels: 1;2;3;4;17;21;22;23

Reading Out the Data Logger

Data stored to the data logger can be read out together with time and date either directly at the instrument's control panel or via the serial interface with the ECL command EINT. The following example shows a read-out of all measurement data for channels 1 through 5 in ASCII format:

```
<A> Eint/## 1..5 * **
16.04.93;17:45:00;1;0.5;0.75;0.99;1.36
16.04.93;18:00:00;1.01;0.1;0.76;0.80;0.83
16.04.93;18:15:00;0.99;0.48;0.75;1.02;1.28
    ⋮
```

Querying a Specific Record

Data for a specific date can be read out with the ECL command INDEX. The example below shows the value from the data logger for channel 1 on 16 April 1993 at 6:15 p.m. (in clear text):

```
<A> Index 16.04.93 18h15, Eint/ 1 .
16.04.93 18:15:00 : Eint-863 (01:Motor7) = 0.99 kWh
```

Data Logger Memory Structure

The data logger is a toroidal-core memory of fixed size which is formatted accordingly. Access is made with an index number. Index 0 always refers to the current interval, index 1 to the last interval and index 2 to the interval before the last etc. The ECL command INDEX transforms a time entry into the corresponding index number.

Toroidal-Core Memory

When memory capacity has been used up, the oldest record (the record with the highest index number) is deleted to make room for the newest record. The interval which has just been completed is thus assigned index number 1, and the index numbers for all previous records is increased by 1.

Range of Values for the Data Logger

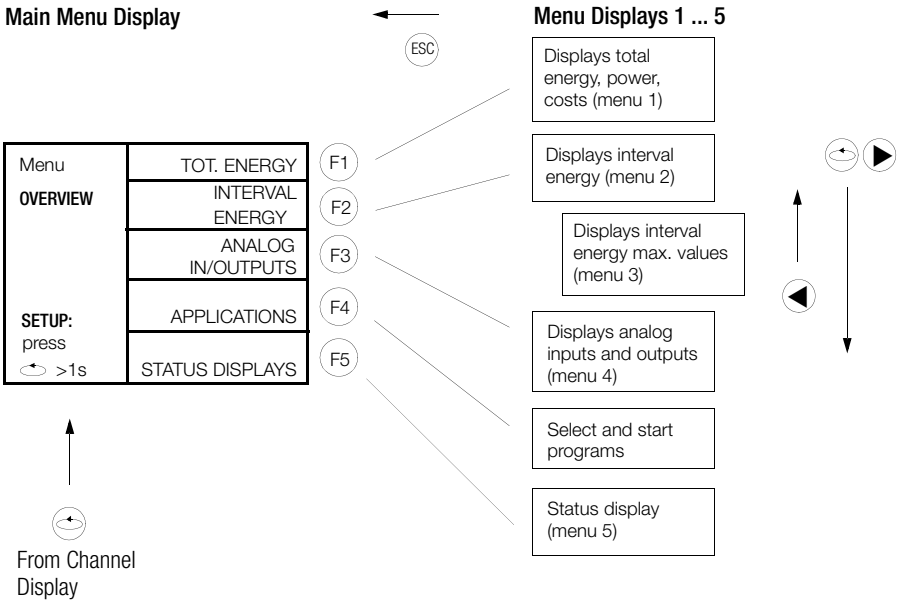
Limitation of Resolution to Reduce Data Volume
All data registers at the summator are internally 8 bytes wide (64 bit floating point). However, where the data list is concerned (as of Eint-1), for which overall memory duration is directly dependent upon available memory capacity, a format with a width of 2 bytes must be used (which results in a loss of accuracy). Since only energy values are stored to memory (and no power values since these are calculated), standard "0" formatting results in the following limitation of the range for values:

Range of Values	Resolution
–0.8191 ... 0 ... +0.8191	Resolution: 0.0001
–81.91 ... -0.82, +0.82 ... +81.91	Resolution: 0.01
–8191 ... -82, +82 ... +8191	Resolution: 1.0
–819100 ... -8200, +8200 ... +819100	Resolution: 100

5 **Operation** (menu displays)

The U1602 micro-summator and the U1603 mini-summator are not equipped with any display or operating elements. Communications and parameters configuring are accomplished with ECSwin software. The display which appears in the control panel mode is identical to the operating menus provided with the U1601 summator.
Extreme caution must be exercised when changing the parameters for the COM1 and COM2 serial ports.
If the settings are changed, no communication takes place between the PC and the summator. Only one port should be changed at any given time, so that the summator can still be controlled with the other. COM2 must be set to ECL or ECL+HP.

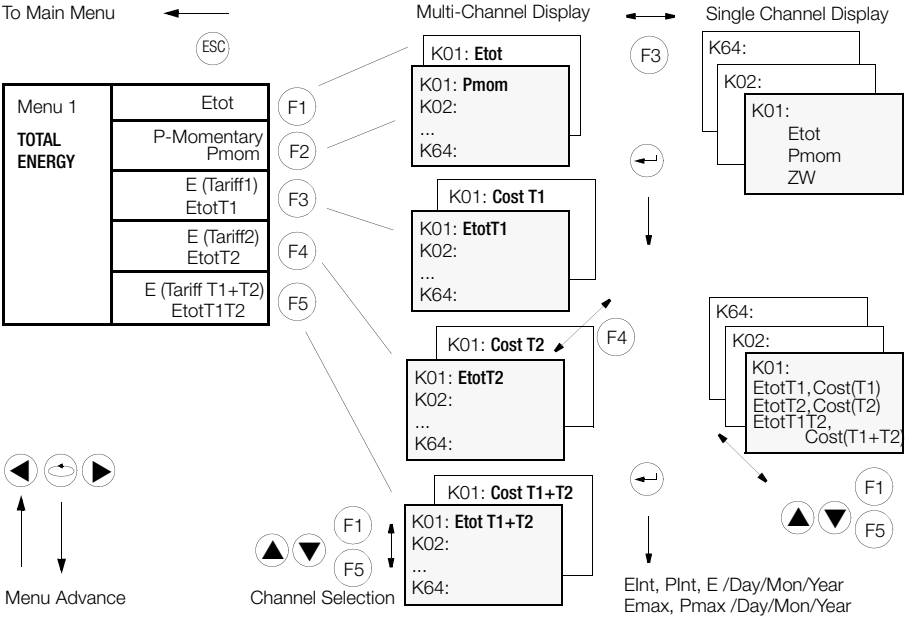
5.1 Menu: Overview (main menu display)



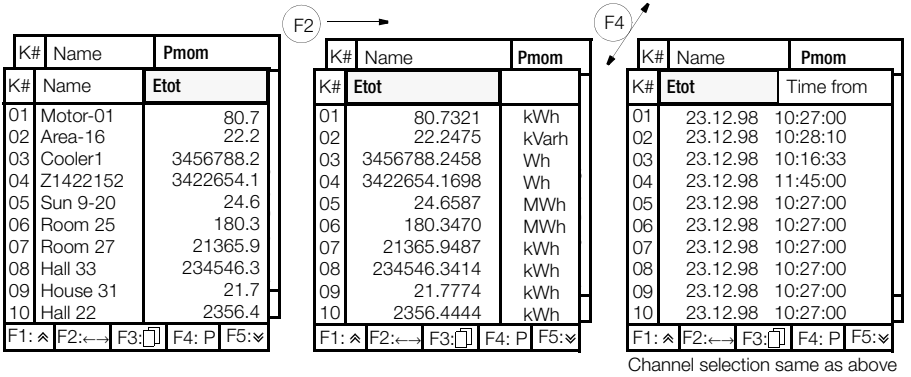
The following applies in general to the sub-menu displays:

Use the ▲ ▼ keys to advance 1 channel and the F1 F5 keys to advance 10 channels.

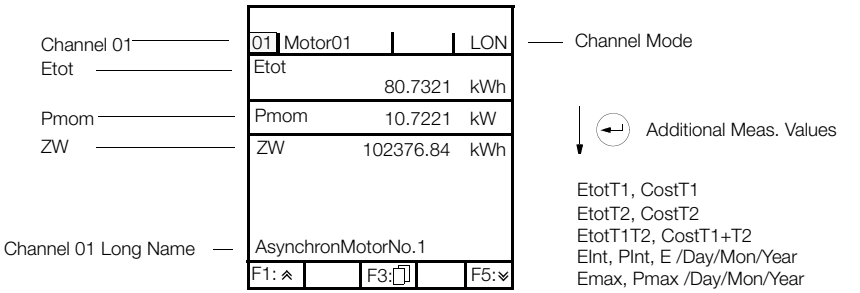
5.2 Menu 1: Display Total Energy, Power and Costs



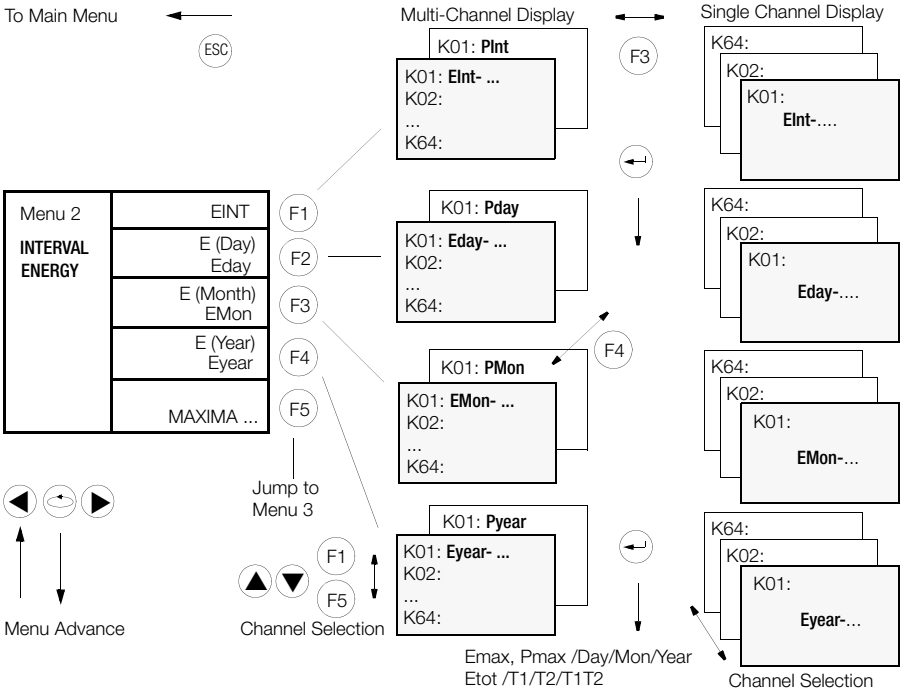
- Multi-Channel Display (all channels with only 1 measurement value)



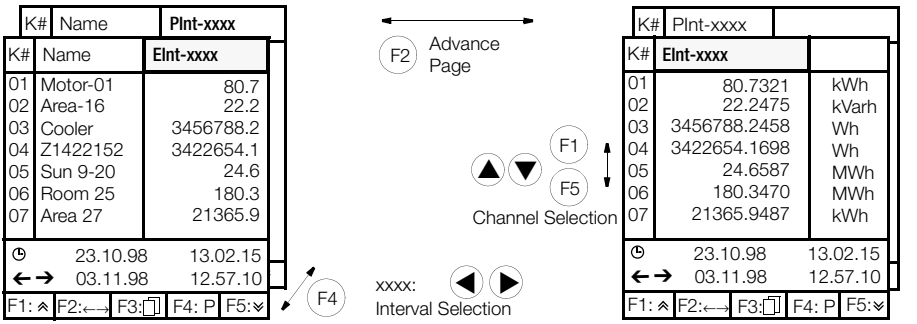
- Single Channel Display (1 channel with all measurement values)



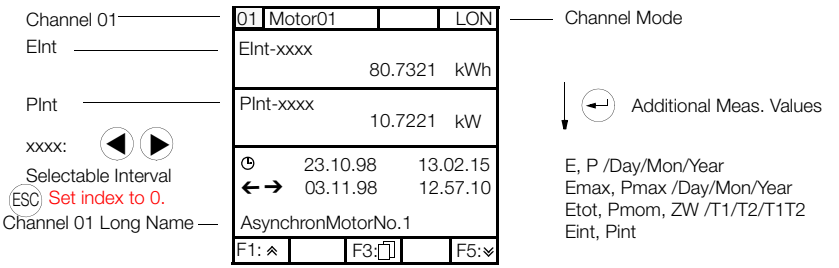
5.3 Menu 2: Display Interval Energy



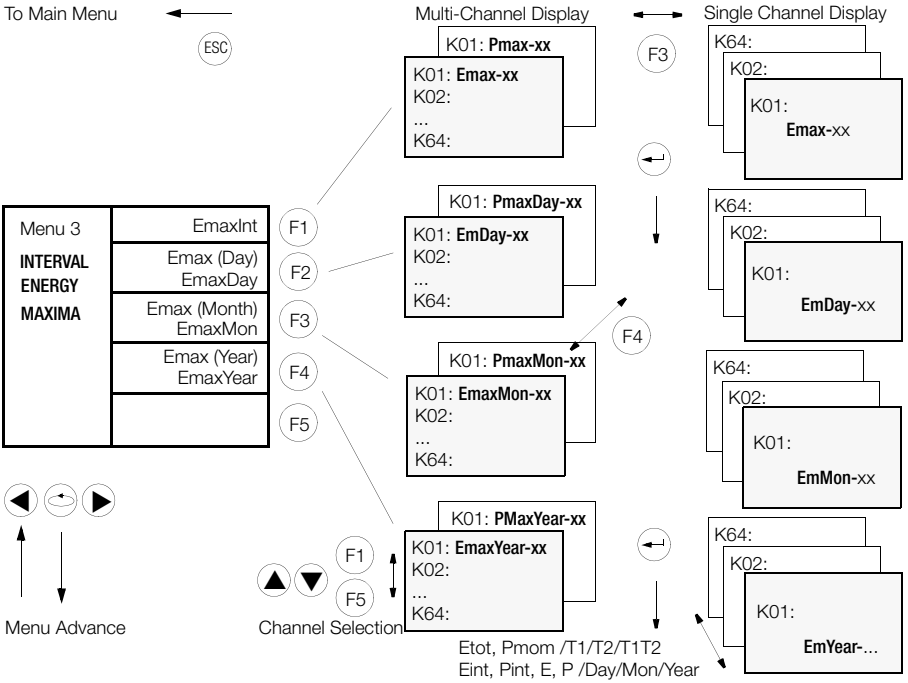
- Multi-Channel Display



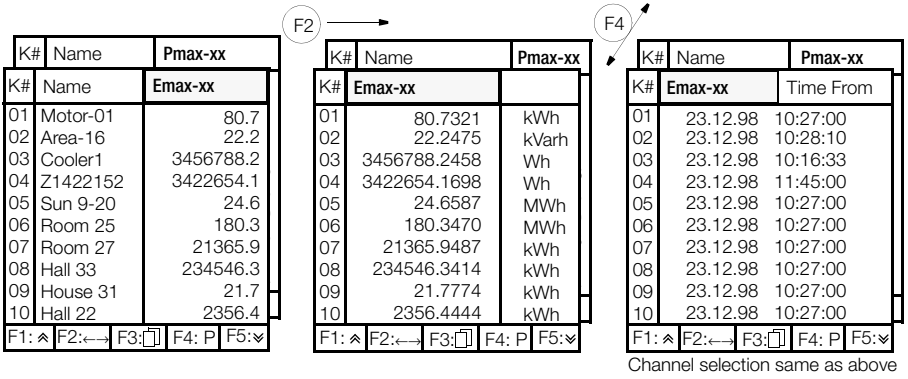
- Single Channel Display



5.4 Menu 3: Display Maximum Values for Interval Energy

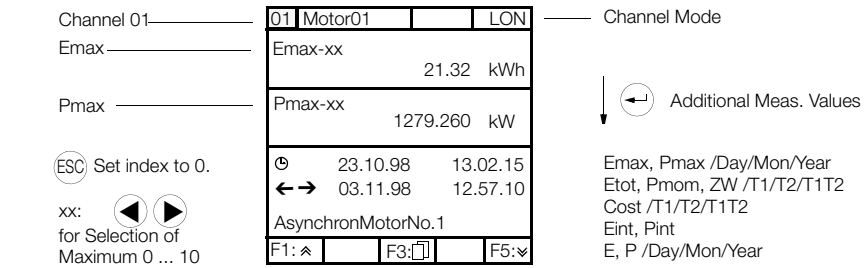


- Multi-Channel Display

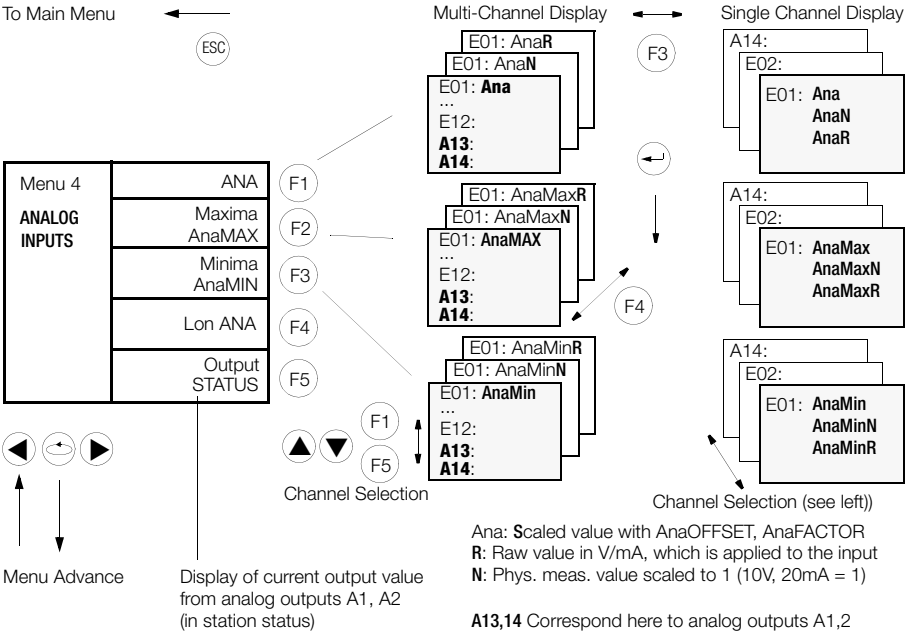


Channel selection same as above

- Single Channel Display



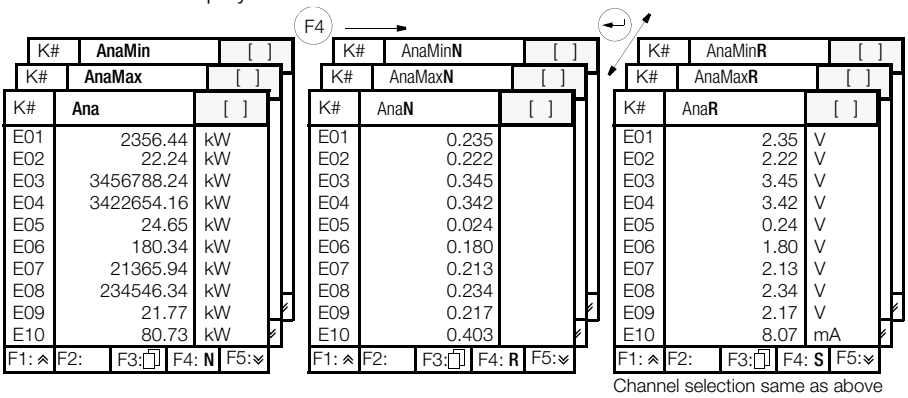
5.5 Menu 4: Display Analog Inputs and Outputs



Ana: **S**caled value with AnaOFFSET, AnaFACTOR
R: Raw value in V/mA, which is applied to the input
N: Phys. meas. value scaled to 1 (10V, 20mA = 1)

A13,14 Correspond here to analog outputs A1,2

- Multi-Channel Display

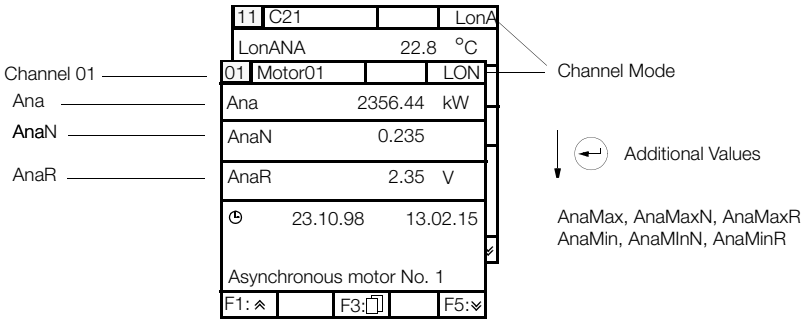


Channel selection same as above

K#	Name	LonANA
11	C21	22.8
12	Vorlauf1	73.4

F1: F2: F3: F5:

- Single Channel Display



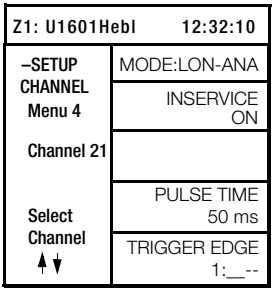
5.6 In-Service Function

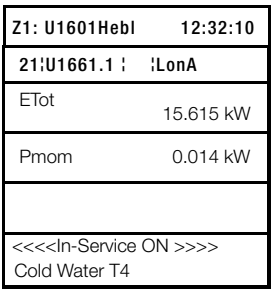
An error bit is used in order to inform the analysis software that a channel is not reading out valid data because, for example, it is currently being calibrated (ErrChan 24: inservice).
The in-service function is activated by configuring the in-service feature:
Example: INSERVICE FEATURE = 3

In-Service	Explanation
0	In-service not available (default setting)
1	In-service available
3	Same as 1, but direct jumping from the individual basic display to SETUP CHANNEL menu 4 is also possible by pressing the F4 key
5	Same as 1, but in-service can only be activated for one channel
7	Same as 3, but in-service can only be activated for one channel

In-service can be configured with CHANNEL DATA under SETUP in menu 4:
InService OFF / InService ON / ALL OFF

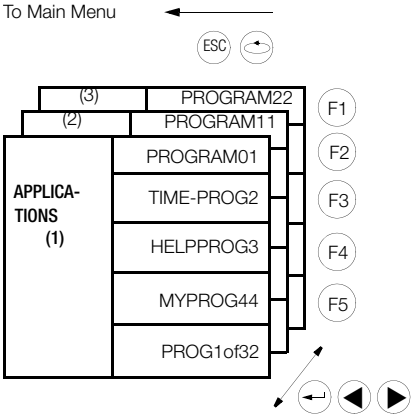
In-service activation is indicated in the individual basic display.





The *ERIS enumeration is used specifically with the in-service function.
Example: All, Channel& *eris reads out all channels with the in-service status.

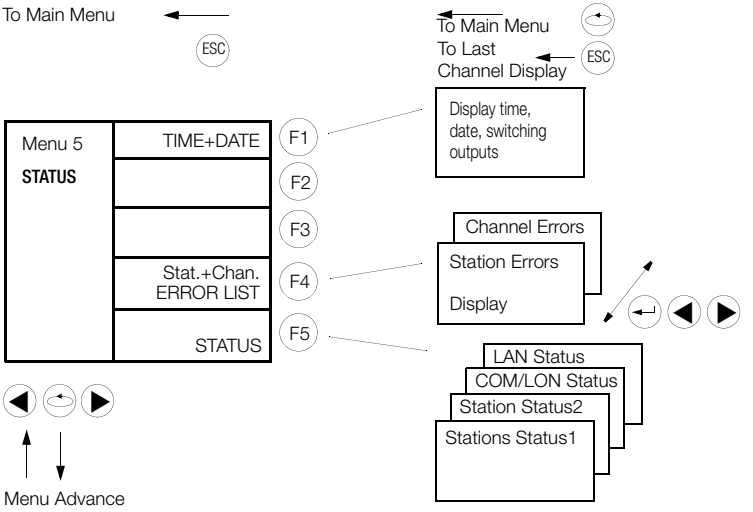
5.7 Menu: Display Applications



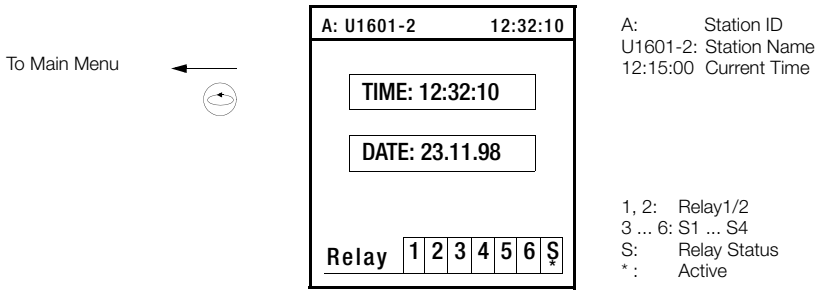
15 programs can be entered here which have been created with the ECL interpreter and have been uploaded to the summator via the data interface.
These are15 of 32 possible P programs which are capable of performing single operations by pressing a key, but which cannot execute cyclical tasks, for example:

– Perform calculations (weighting for energy values)
– Read out specific energy channels via the data interface

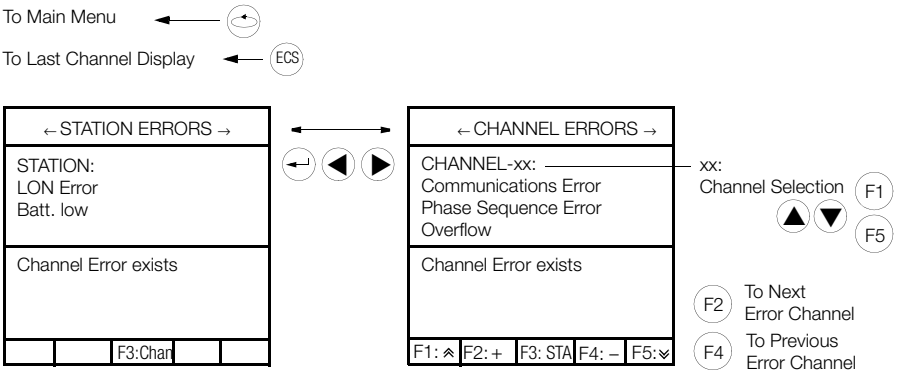
5.8 Menu 5: Display Status Menu (time, relays, errors, interfaces)



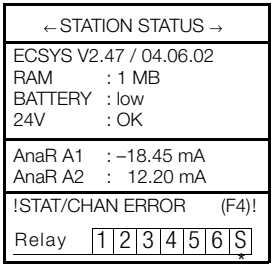
- Display Time, Date and Relays



- Display Station / Channel Errors (see error table)



- Status Displays

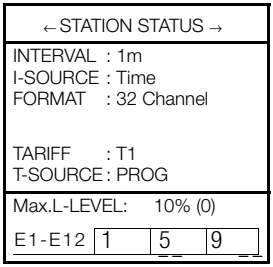


Operating system, version, date created
Summator memory capacity
Battery charge level
24V supply power U_V for external switching contacts

Instantaneous values for analog outputs A1, A2

Channel or station error has occurred (display with F4)

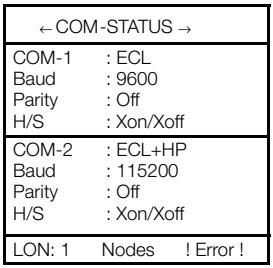
Relay and S0 output switching status:
1,2: Relay 1/2
3 ... 6: S1 ... S4
S: Relay status
(* = active



Selected energy interval time: 1 minute
The internal clock is used as the interval source
Number of channels from which interval values, Eint, are to be generated (see FORMAT commands)

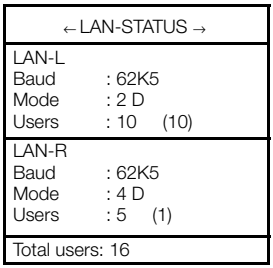
Currently selected tariff
Tariff source is an H program which switches among the

Maximum low level for inputs E1 ... E12, when they are used as S0 inputs
Level for inputs E1 ... E12: _low, ¯high



ECL operation
Selected baud rate
No parity
Handshake mode

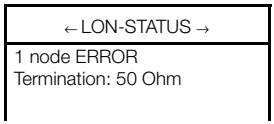
ECL operation and read-out via background programs is possible via COM2.



Selected baud rate
2-wire connection (Bus)
Number of users: 10 total, of which (10) are direct

Selected baud rate
4-wire connection (point-to-point)
Number of users: 5 total, of which (1) is direct

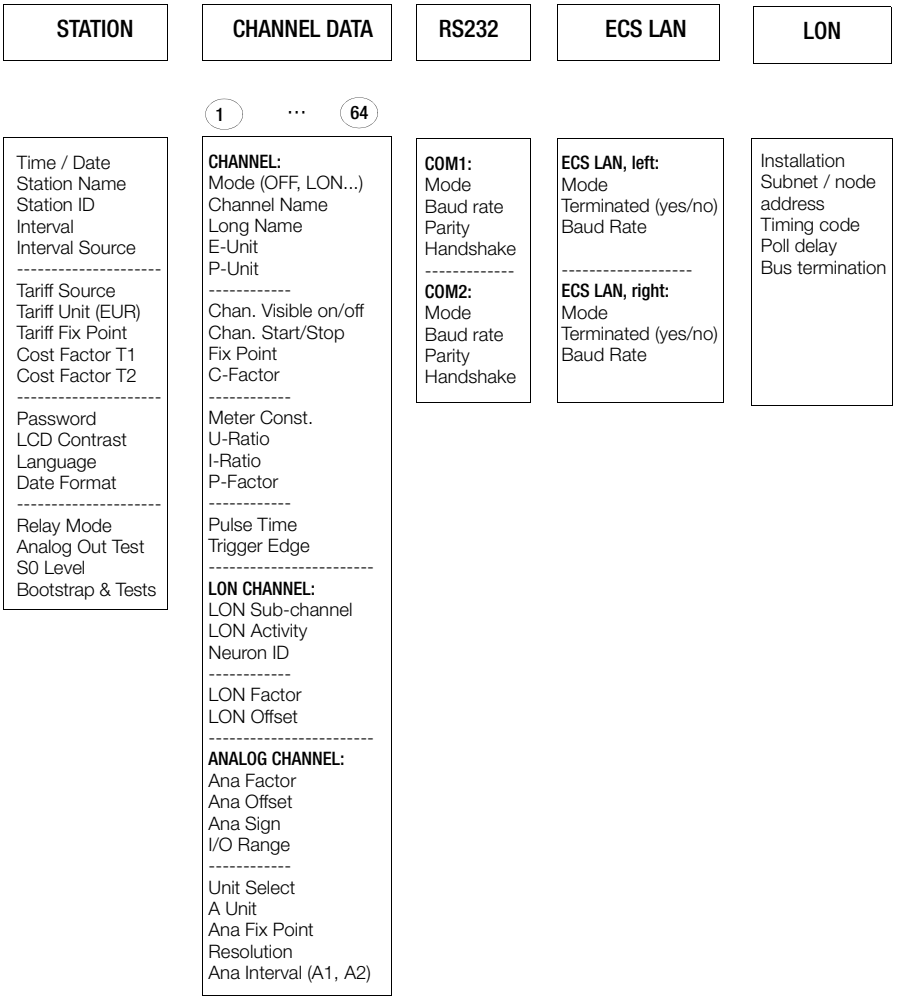
16 users are present at the LAN L/R (including this station)



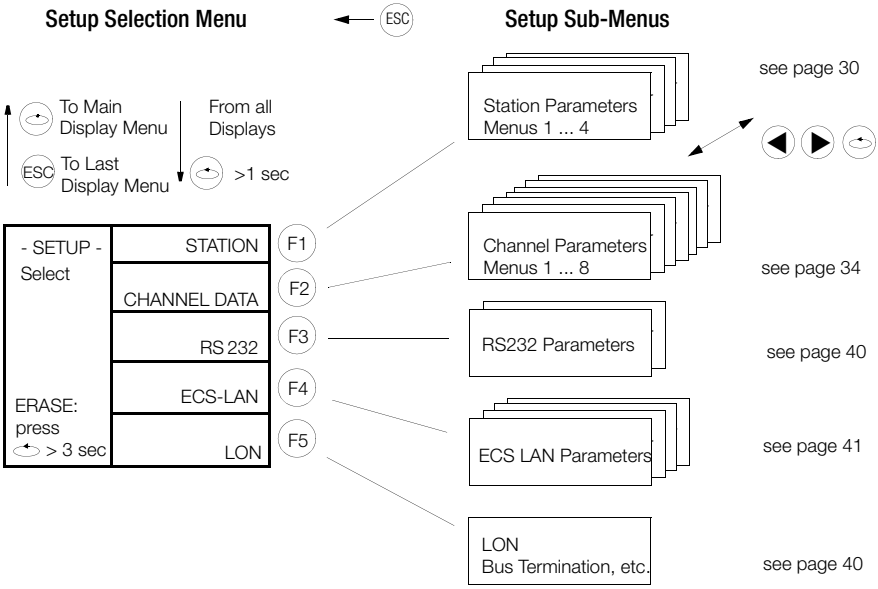
On meter (node) has been found at the LON bus.

6 Basic Configuration

6.1 Setup Parameters Overview

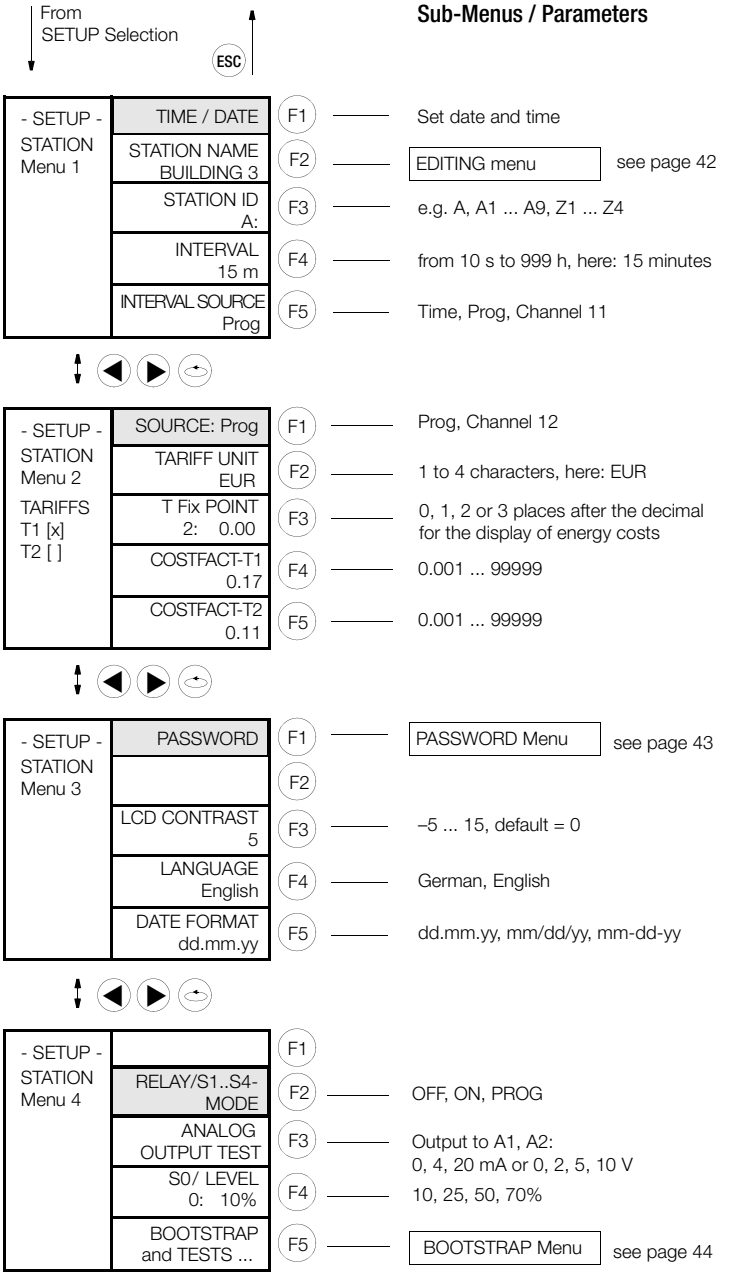


6.2 Setup Selection Menu



see page 42 for DELETE menu

6.3 Station Parameters (IDs, intervals, tariffs, outputs, ...)



(1 Password must first be entered

Time / Date

After the time has been entered to the first line, the cursor jumps to the date line. Entries have an immediate effect on the integrated real-time clock, and for this reason entry cannot be interrupted. ECL command: TIME/DATE

Station Name

The station name must have a length of between 1 and 8 characters. If no name is entered, the name "-" is automatically assigned to the station. The following characters can be used: _ + – 0 ... 9 A ... Z a ... z. ECL command: STATION

Station ID

Each station within the ECS LAN must have its own unique ID. The same ID may not be used more than once. Up to 255 IDs can be assigned. The ID has a maximum length of 2 characters. If a blank is entered into the character string, the string is truncated as of the blank when the entry is acknowledged with F4. IDs have the following format: A, A1 ... A9, B, B1 .. B9 ... Z, Z1 .. Z4.

Interval

Range of possible entries for the synchronization interval: 10 seconds ... 999 hours (entry in seconds). ECL command: INTERVAL (ITV)

Interval Source

The synchronization interval can be generated in three different ways:
Time: Intervals are generated based upon the selected interval duration.
Program: An interval is only generated by the ECL command: SYNC=.
Channel 11: A meter input serves as a binary input for the synchronization signal. The selected pulse duration and pulse edge are taken into consideration.
ECL command: INTERVAL SOURCE (IQ)

Source (tariff source)

Selection of the appropriate tariff T1 or T2 can be made in two ways:
Channel 12: A meter input serves as a binary input for determining the valid tariff. The selected pulse duration is taken into consideration. The pulse edge parameter is used to determine which level is assigned to tariffs T1 and T2. If the "+" edge (1) is selected: low level (0 V at input) corresponds to tariff T1, and high level (24 V) to tariff T2. If the "-" edge is selected, these relationships are reversed.
Program: The appropriate tariff is selected with the ECL command TARIFF=1 or TARIFF=2. These commands are only enabled if "Program" has been selected as the source. ECL command: TARIFFSOURCE (TQ)

Tariff Unit

The maximum length for the tariff unit of measure is 4 characters. The tariff unit of measure must be at least one character long. ECL command: TUNIT

T Fix Point

Determines the number of places after the decimal point which are used for the display of incurred energy costs. ECL command: TFIX

Cost Factors T1 and T2

Cost factors are entered in the same way for tariffs T1 and T2.
The cost factor is used to convert energy values into costs. This conversion can be applied to the total energy registers for tariffs EtotT1 and EtotT2, as well as EtotT1T2.
Cost factors can be entered within a range of 0.000 to 99.999
ECL command: COSTFAC1, COSTFAC2.

Password
This function provides a sub-menu for the entry of passwords for 5 users (see page 43).

LCD Contrast
This menu allows for an adjustment of the contrast at the LCD. 20 different contrast levels are available (–5 to +15). The default setting is 0 and provides for good results in most cases.

Language
All menus, ECL messages and online help are displayed in the selected language. ECL command: LANGUAGE

Date Format
3 different formats are available: dd.mm.yy, mm/dd/yy, mm-dd-yy.

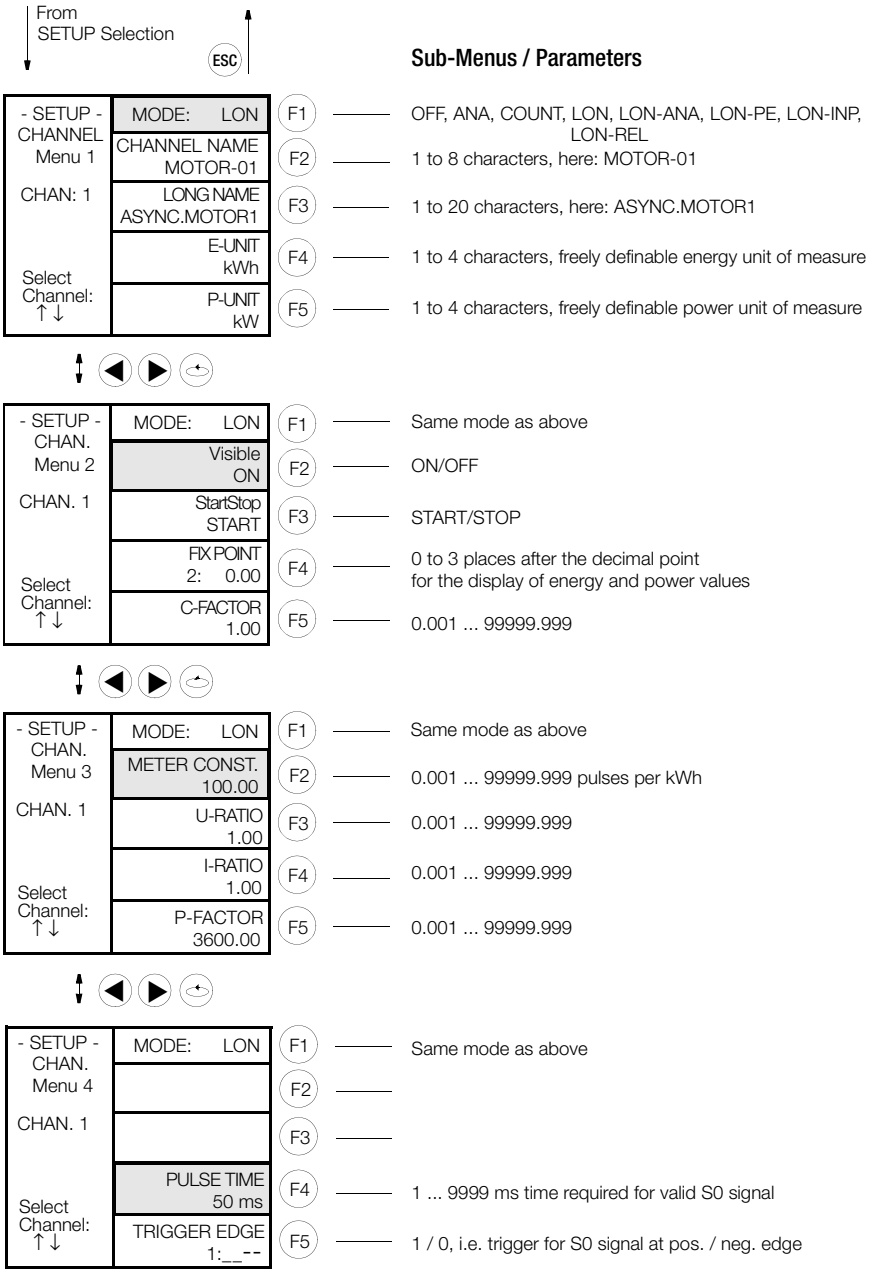
Relay / S0 Mode
Determines the operating mode for relays 1 and 2, as well as S0 outputs S1 ... S4. If PROG is selected, a user program (H/P program) determines the status of the outputs. ECL command: RELM.

Analog Output Test
Voltage or current values can be read out from analog outputs A1 and A2 for test purposes with this function. Selection of either voltage or current output can be made in the menu: SETUP CHANNELS (I/O RANGE) (see page 38).

S0 / Level
The sensitivity of the S0 input channels (S1 ... S4) can be selected as a percentage (10, 25, 50 or 70 %). ECL command: LEVEL

Bootstrap and Tests
Open the bootstrap loader in the bootstrap menu (see page 44).
LON Test Display: Display of several important LON parameters.
LCD Test: Tests for correct functioning of the 4 LEDs and the LCD. All four LEDs light up and a checkerboard pattern appears at the LCD during this test.
Keyboard Test: All of the instrument's keys are displayed at the LCD and activation of each key is acknowledged at the LCD.

6.4 Channel Parameters (mode, name, units, displays, ...)



Mode

The following selections can be made with the following sub-menus:

OFF:	The channel is switched off entirely and all functions are deactivated.
ANA:	The applied analog quantity is displayed for this channel with the corresponding “A UNIT” (see A-UNIT parameter on page 39).
Count:	A binary input quantity is used for energy measurement in accordance with the S0 standard.
LON	Measured energy data are made available to the system via linking amongst various LON users.
LON-ANA	Analog values via LON for A2000, DME400, U1661 and U1680
LON-PE	Same as LON-ANA, plus energy is calculated based on LON analog values
LON-INP	Binary inputs via LON for U1660
LON-REL	Relay outputs via LON for OCL210

Channel Name

Each physical channel can be assigned a name for the purpose of improved identification. The name need not be unique, unless it is also used as a field name for a database. The length of the name may not exceed 8 characters, and it must be at least one character long. ECL command: CHANNEL

Long Name

An expanded channel name including up to 20 characters. ECL command: LNAME

E-Unit, P-Unit

A freely definable energy unit of measure (e.g. kWh) and power unit of measure (e.g. kW) can be assigned to each physical channel. The units of measure may not exceed a length of 4 characters, and must be at least one character long.
ECL command: EUNIT, PUNIT

(Channel) Visible

Each physical channel can be made visible or invisible for queries from the control panel or for “*” - lists during interpreter operation. The function of the channel remains otherwise unchanged! If, for example, only channels 1 through 3 are visible, values can only be queried for these channels in the normal display mode, and the instrument appears to be a 3 channel device. If “Etot*”, is queried during interpreter operation, total energy is only displayed for these three channels.
If all channels have been deactivated, time and date are displayed in the normal display mode. These entries are immediately effective and need not be acknowledged.
ECL command: ONOFF

Channel Start/Stop

The acceptance of meter pulses at a given input is controlled with the Start/Stop function. A channel which has been created by means of t “differential linking” can be influenced with the Start/Stop function in an analog fashion. Since the binary input status of the channel is not influenced, undesired counting of binary data can, for example, be avoided with this function. These entries are immediately effective and need not be acknowledged. ECL command: STARTSTOP (STSP)

Fix Point

A determination can be made as to how many places after the decimal point will be used for the display (not the calculation) of energy or power values for each physical channel.

(0) No places	0	(2) Two places	0.00
(1) One place	0.0	(3) Three places	0.000

These entries are immediately effective and need not be acknowledged.
ECL command: CFIX

C-Factor

The following can, for example, be accomplished with this function: The measured quantity is consumption in cubic meters. This quantity needs to be displayed in the unit of measure *standard cubic meters* [Nm^3], so that a correction factor is required. This (C-Factor) is thus the desired multiplication factor used for the calculation of the energy value for a given channel.

Meter Constant

The meter constant can be defined individually for each physical channel. It indicates how many meter pulses are generated by a connected meter per kWh, and is used in the formula for the calculation of energy (see page 7). ECL command: MCONST

U-Ratio, I-Ratio

The Uratio and Iratio factor can be defined individually for each physical channel (see page 7 for calculation formula).
Sign Changes (+, -): Press “<<” (F2) when the cursor is all the way to the left.
Range of possible entries for Uratio and Iratio: 0.000 ... 99999.999
If the Uratio or Iratio factor is set to zero for a given channel, meter pulses can be disabled for the channel in question. However, it is better to use the Start/Stop function for this purpose. ECL command: URAT, IRAT

P-Factor

The P-Factor can be defined individually for each physical channel (see page 7 for calculation formula).
Sign Changes (+, -): Press “<<” (F2) when the cursor is all the way to the left.
Range of possible entries for Uratio and Iratio: 0.000 ... 99999.999
ECL command: P-FACTOR

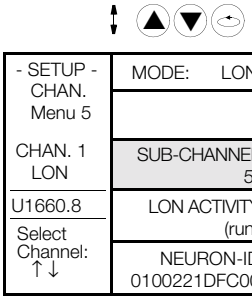
Pulse Time

The duration for which a pulse must be applied to the S0 input of a channel in order to be recognized as an S0 pulse (debouncing time). ECL command: PULSE

Trigger Edge

Determines whether the meter pulse is triggered at its positive (1) or negative (0) edge.
ECL command: EDGE

Sub-Menus / Parameters



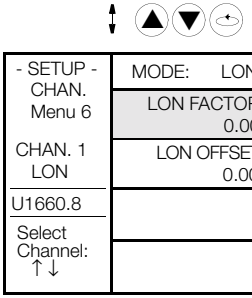
F1 — OFF, ANA, COUNT, LON, LON-ANA, LON-PE, LON-INP, LON-REL

F2 —

F3 — LON user has 8 channels, channel 5 is displayed

F4 — RUN, STOPPED

F5 — 12 place address for the selected LON user



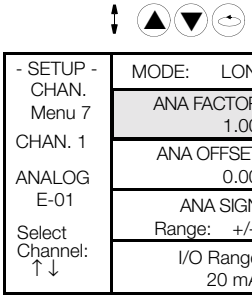
F1 — Same mode as above

F2 — 0.001 ... 99999.999

F3 — 0.001 ... 99999.999

F4 —

F5 —



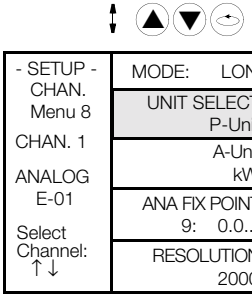
F1 — Same mode as above

F2 — 0,001 ... 99999,999

F3 — 0,001 ... 99999,999

F4 — +/–, +, –

F5 — 5mA, 4-20mA, 20mA, 10V, S0



F1 — Same mode as above

F2 — None, E-Unit (energy), P-Unit (power), A-Unit (analog value)

F3 — Freely definable dimension, if an analog input quantity (A-Unit) is to be displayed

F4 — 0, 1, 2, 3 or 9 determines number of places after the decimal point for the display

F5 — 100 ... 10000

Mode

see page 35 above

LON Channel

The LON user which has been selected with its neuron ID has 8 channels. Channel 5 is displayed at local channel 1, if channel 1 has been set to the LON mode.

LON Activity

If a LON user malfunctions, all local channels which are used to display LON channels indicate errors. In this way, the LON channel can be displayed (run) or suppressed (stopped) without switching off individual channels.

Neuron ID

This is the internationally unique address for a LON user and consists of a 12 place hexadecimal value. The summator automatically establishes contact with the LON user which has been assigned to this address. If the local channel has been set to the LON mode, the suppressed “LON channel” is displayed (channel 5 from the previous example).

LON Factor, LON Offset

LON user values are scaled to a value of -1 ... 0 ... +1.
The range characteristics can be freely adapted to the measuring task with the LON Factor and LON Offset parameters. ECL commands: LONFACTOR, LONOFFSET

ANA Factor, ANA Offset

Analog output values are scaled to a value of -1 ... 0 ... +1.
The range characteristics can be freely adapted to the measuring task with the Ana-Factor and Ana-Offset parameters. ECL commands: ANAFACTOR, ANAOFFSET.

Sign (+, -)

Indicates the polarity of the input and output signals. + and - correspond to positive and negative signals from the appropriate input or output. ECL command: ANASSEL

I/O Range

Indicates the range of the respective analog input or output. Possible ranges include: 5 mA, 4 - 20 mA, 20 mA, 10 V, S0. The hardware must also be set to the same value. The required DIP switches are located under the cover plate at the top of the instrument (see page 52).

Unit Select

Determines which unit of measure (none, energy, power, analog value) is used for the display of the channel’s input quantity. ECL command: ANAUSEL

A-Unit

Freely definable magnitude for the display of measured quantities, if these are measured as analog values, e.g. kW, °C, m^3, mA. The display can include up to 5 places.
ECL command: AUNIT

ANA Fix Point

Determines the number of decimal places used after the comma for the display (not the calculation) of the measured analog quantity for each physical channel.

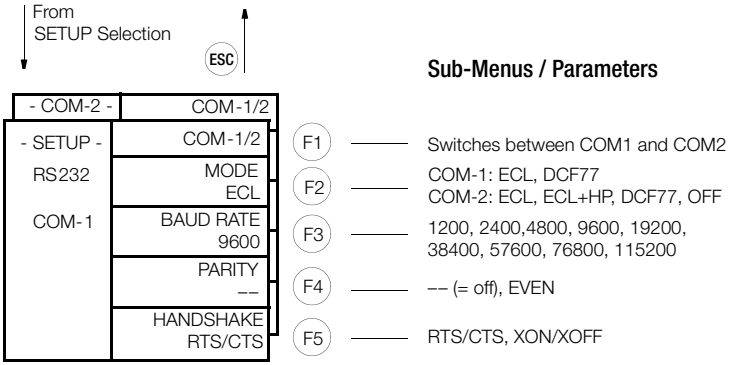
(0) No places	0	(2) Two places	0.00
(1) One place	0.0	(3) Three places	0.000

(9) Floating decimal point

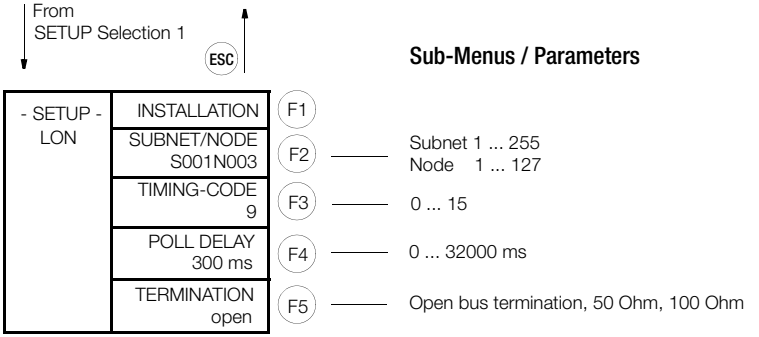
These entries are immediately effective and need not be acknowledged.
ECL command: ANAFIX

Resolution
For the 12 analog input channels E1 ... E12. ECL command: ANARESO

6.5 RS232 Menu

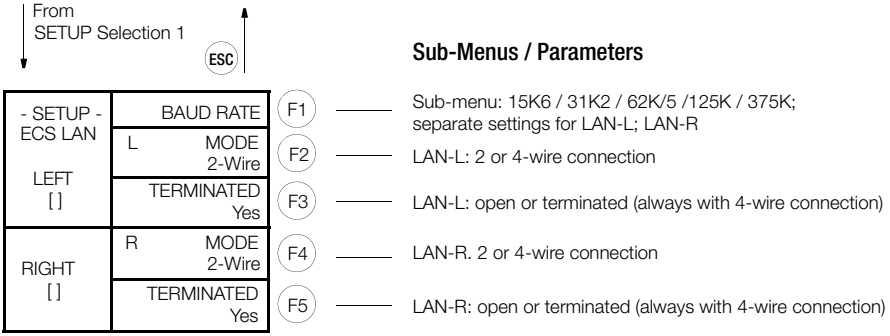


6.6 LON Menu



INSTALLATion	All LON users are sought out and reinstalled.
SUBNET/NODE	LON address of the summator
TIMING CODE	Waiting time is set for a response with TIMING CODE.
POLL DELAY	POLL DELAY is waiting time between queries from 2 channels in milliseconds.
TERMINATION	LON network termination is set via TERMINATION.

6.7 ECS LAN Menu

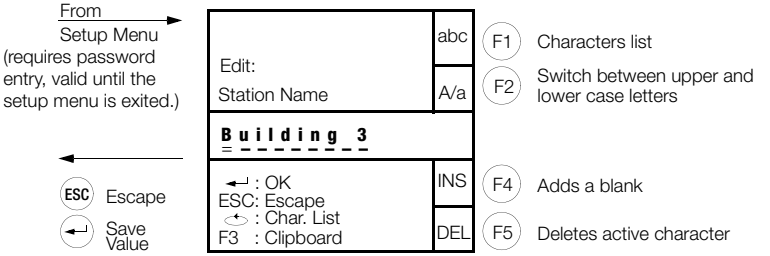


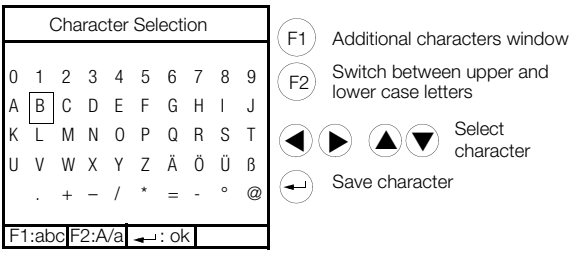
LAN-L: Settings for LAN left (terminals 49 through 52)
LAN-R: Settings for LAN right (terminals 53 through 56)

2-wire connection is normally used (terminals 45 + 46 or 49 + 50), and this is the only possibility which allows for bus configuration with multiple users at the same bus cable. In this configuration the first and the last instruments on the bus cable must be terminated with the internal matching resistors. Proper functioning of the bus is not possible if the terminating resistors are not activated (Bus LED LAN/L or LAN/R blinks). For long transmission distances, or if boosters are required, 4-wire connection can be used (only line-to-line connection is possible). The required terminating resistors are automatically activated. The default baud rate is 62.5 kBaud.

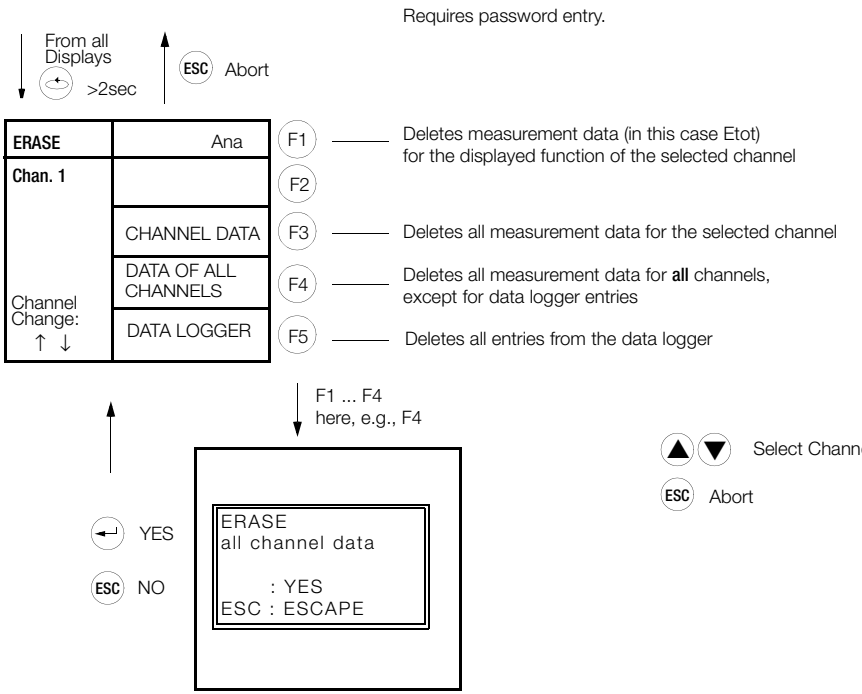
6.8 SETUP Sub-Menus (edit, erase, outputs, bootstrap loader, password)

EDIT Menu (example)

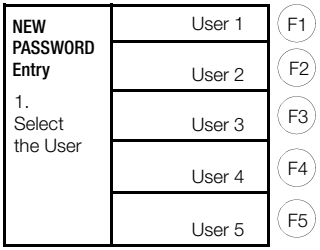




'ERASE Menu



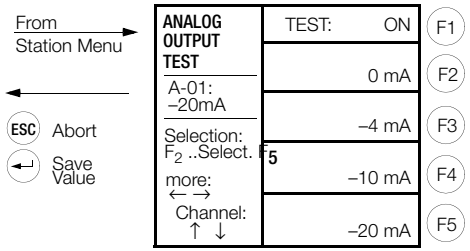
Password Menu



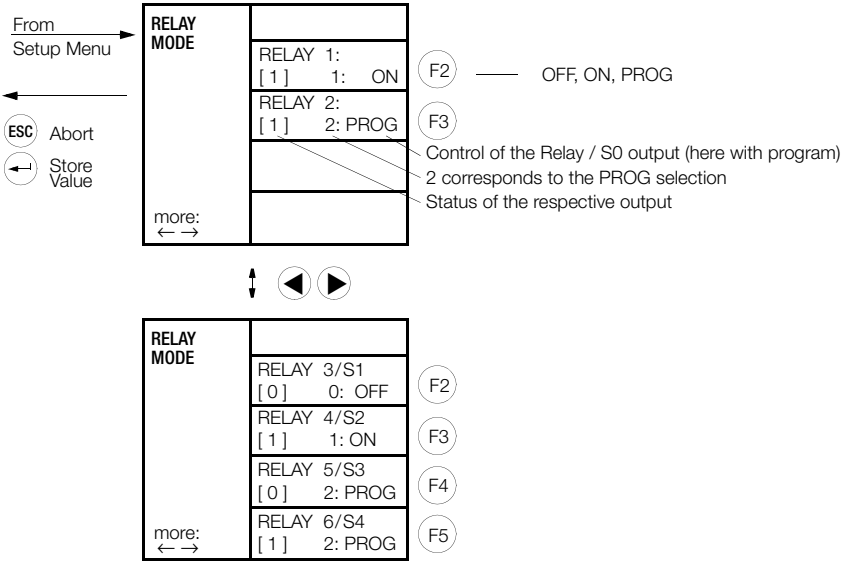
Passwords consist of a combination of the F1 through F5 keys and always have 6 places.

When the summator is shipped, all of the passwords have been deleted: any user is able to configure parameters. If this needs to be avoided, passwords can be entered for 5 users:
Enter a password for user 1 first (master). Passwords for other users (2 through 5) cannot be entered until the password for user 1 has been entered. After the password for user 1 has been entered, parameters can be changed for a period of 5 minutes if none of the keys are activated. After this time period, or after an instrument self-test, password entry is once again required.
Each user can change his password at will.
After the user has logged on with his password, he has only 5 minutes to change his own password, even if none of the keys have been activated during this time.
If password protection is to be cancelled for all users, user 1 (master) must enter special password “1111111”. The system deletes all passwords and parameters can be configured by any user.

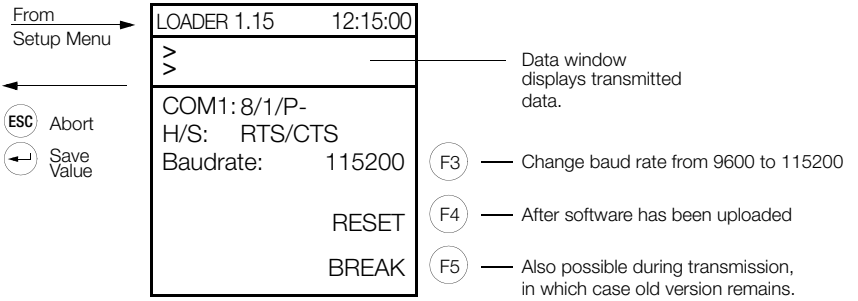
Analog Output Test



S0/Relay Output Menu



BOOTSTRAP Menu



Firmware Update

The operating system is stored to flash memory. Summator updating is performed on site via the serial interface.

Required Tools

- PC with serial interface. Notebooks are best suited because they can be operated without mains power.
- Null modem cable, e.g. GTZ 5232 000 R0001 (RTS/CTS conductors must be used due to high baud rate).

Preparation

- Download the new firmware version from our website:
  http://www.gmc-instruments.com
  Save it to an empty directory and decompress the files.
- Connect the summator (COM 1) and the PC with the null modem cable.
- Disconnect the LON bus plug from the summator.

Updating a U1601 Summator (bootstrap loader menu)

- Set the summator to the download mode (bootstrap loader):
  Press and hold the menu key until the SETUP SELECT menu appears.
  Press the F1 key = STATION.
  Press the menu key three times, after which menu 4 appears.
  Press the F5 key = BOOTSTRAP AND TESTS ...
  Press the F1 key = BOOTSTRAP until the loader menu appears.
  The summator is now ready to receive data.
  LCD contrast can be adjusted with the UP/DOWN keys.
  German or English can be selected in the language dialog with the F2 key.
  The baud rate can be adjusted with the F3 key. The default value of 115,200 baud has proven itself in actual practice, and other values should only be used in extraordinary cases.
- The version is displayed in the first line of the bootstrap loader. If your device is not equipped with the current bootstrap loader, it is advisable to install the new version. Before downloading the firmware, transmit the current bootstrap loader to the device with the following batch file: TRBOOT.BAT. Then reset the summator to the download mode (bootstrap loader).
- Start the download at the PC with the UPDATE.BAT batch file.
  “Receiving data ...” appears at the summator’s display during downloading. Error-free data transfer is indicated with the “Transmission OK” message. Any other messages indicate an error, in which case downloading must be repeated.
- Start reinstallation of all LON nodes: SETUP-SELECTION / LON / INSTALLATION.
- Plug the LON bus back in.
- Check for correct functioning.
  Check LON type for all channels: SETUP-SELECTION / channel data / menu 5. If LON type is ??????.?:
  Start reinstallation of the channel by changing the neuron ID.
  For example, set the first digit to 1, and then back to 0.
  If the type is displayed correctly: Check to see if any channel errors have occurred.
  When was Etot last updated? Lastupd * reads out time in seconds.

Updating a U1601 or U1603 Summator (bootstrap loader menu)

- Set the summator to the download mode:
  Press and hold the BOOT button with a pencil until the LEDs go out briefly. When the button is released, the 4 LEDs start blinking. The LED which remains illuminated the longest indicates the utilized baud rate:
  STATUS: 115,200 Baud
  LAN/L: 38,400 baud
  LAN/R: 19,200 baud
  LON: 9600 baud
  The baud rate can be changed by pressing the BOOT button.
- If your device is not equipped with the current bootstrap loader, it is advisable to install the new version. Before downloading the firmware, transmit the current bootstrap loader to the device with the following batch file: TRBOOT.BAT. Then reset the summator to the download mode.
- Start the download at the PC with the UPDATE.BAT batch file.
  A bar graph appears when data are received by the summator, and cycle time is increased during receiving pauses. If an error occurs, the status LED blinks once per second for approximately 4 seconds.
  After transmission has been successfully completed, the summator returns to the normal operating mode. In order to return manually, press and hold the BOOT button for more than 2 seconds and then release.
- Start ECSWin.
- Start reinstallation of all LON nodes: LonRe ** = 1.
- Plug the LON bus back in.
- Check for correct functioning.
  Check LON type for all channels: Enter LonType **.
  If LonType = ??????.? for any channel: Start reinstallation for that channel: LonRe c = 1.
  If the type is now displayed correctly: Check for channel errors with Errchan **.
  When was Etot last updated? Lastupd * reads out time in seconds.

Note:

UPDATE.BAT transmits the firmware code as well as ECL help texts. The bootstrap loader is thus started twice when the batch file is executed (first for the HR.MOT file, and then for the HELP.MOT file).
If you want transmission to take place via the PC's COM2 port, or if you would like to use a transmission speed of other than 115,200 baud, the batch files must be edited correspondingly. Syntax is as follows:
"urlader <COM number> <baud rate> <download file> [/r]"

<COM number >	:	Number of the COM port (1, 2, 3 or 4)
<Baud rate>	:	Transmission speed (9,600, 19,200, 38,400, 57,600 or 115,200)
<Download file>	:	file to be transmitted (HR.MOT, HELP.MOT, BOOT.MOT)
/r	:	(optional) execute reset after transmission: causes automatic return to the normal operating mode.
Example:		"bootstrap loader 1 115200 hr.mot /r" for COM1 or "bootstrap 2 115200 hr.mot /r" for COM2

6.9 Master Reset

A normal reset is performed each time auxiliary power is interrupted, and each time the integrated watchdog is triggered. Neither measurement data nor parameters are deleted during this process.
If, however, all of the measurement data need to be deleted and the parameters need to be reset to their original default values, a master rest can be performed at the keypad on the U1601 summator. This reset can only be activated within 7 seconds after the summator has been switched on. Press and hold the following keys simultaneously for at least three seconds in order to perform a master reset:

F1 + F5 + MENU

Master reset can also be triggered with the following ECL command: SYSRESET = 590. The master reset is now performed, after which the instrument returns to its normal display. The following parameters are not effected by the master reset:

ID	Linking of the status relay
Baud rate for the RS232 interface	Language
Parity for the RS232 interface	Password configuration
BUS/L and BUS/R parameters	LON terminal resistor

6.10 Basic Software Configuration

The instrument is configured as follows upon receipt from the factory, or after a master reset:

Station Name		STATION	U1601
ID	*	SETID	A
Synchronization Interval		INTERVAL	15 minutes
Interval Source		IQ	Time
Tariff Source		TQ	Program
Tariff Unit of Measure		TUNIT	EUR
Tariff Fix Point		TFIX	2
Cost Factor, Tariff 1		COSTFAC1	0.20
Cost Factor, Tariff 2		COSTFAC2	0.15
Password	*	PASSWORD	
LCD Contrast		-	5
Language	*	LANGUAGE	German
Relay Mode		RELM	2 (per program)
Level		LEVEL	1
Channel Mode		KMODE	Channel 1 … 12: COUNT 13 … 14: ANA 15 … 64: AUS
Channel Name		KNAME	Channel x
Long Name		LNAME	Long name, channel x
Energy Unit of Measure		EUNIT	kWh
Power Unit of Measure		PUNIT	kW
Visible		ONOFF	ON
Start/Stop Function		STARTSTOP	START
Channel Fix Point		KFIX	2
C-Factor		KFACTOR	1
Meter Constant		MCONST	1
Voltage Transformation Ratio		URAT	1
Current Transformation Ratio		IRAT	1
P-Factor		PFACTOR	3600
Pulse Time		PULSE	50 ms
Pulse Edge		EDGE	1 (+)
LON Activity		LONSTOP	0
Neuron ID		LONID	000 000 000 000
LON Terminal Resistor	*	SetLON	50 Ω
LON-SUBNET/NODE		LonSUBNODE	S001N126 (Subnet = 1, Node = 126)
LON-TIMING-CODE		LonSTATTIMing	9 (384 ms)
LON-POLL-DELAY		LonPOLLDELay	0
LON-Sub-channel		LONKAN	1
LON Factor		LONFACTOR	1
LON Offset		LONOFFSET	0
C-Factor		KFACTOR	1
Ana-Factor		ANAFACTOR	1

Ana-Offset		ANAOFFSET	0
Ana-Sign		ANASSEL	0 (±)
Selected Ana-Unit		ANAUSEL	2
Ana-Unit		AUNIT	kW
Ana-Mode		ANAMODE	3 (count)
I/O Range	*	ANAMODSEL	3 (S0)
Ana Fix Point		ANAFIX	2
Resolution		ANARESO	2000
COM1 Mode	*	SetCOM1	ECL
COM1 Baud Rate	*	SetCOM1	9600
COM1 Parity	*	SetCOM1	Off
COM1 Handshake	*	SetCOM1	Xon/Xoff
COM2 Mode	*	SetCOM2	ECL
COM2 Baud Rate	*	SetCOM2	9600
COM2 Parity	*	SetCOM2	Off
COM2 Handshake	*	SetCOM2	Xon/Xoff
ECS LAN 2-Wire- / 4-Wire Connection	*	SetLanL, SetLanR	BL: 2-wire, BR: 2-wire
ECS LAN Terminal Resistor	*	SetLanL, SetLanR	BL: ON, BR: ON
ECS LAN Baud Rate	*	SetLanL, SetLanR	BL: 62K5, BR: 62K5
Background Program: Daylight Saving / Standard Time		H 31	'SOWI,IF,TIME–,+,TIME=.'
Format		FORMAT	Channels 1 ... 64 in format 0
Group Name		GROUP	ECS
Status Relay Linking		STATCHECK	1 (linked)

*) These parameters remain unchanged after a master reset.

7 Connections

7.1 Terminal Assignments

U1601

Analog / SO																								Relay 1			Relay 1		
+ 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	30

Analog				SO						U_V		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

U1602

Relay 1			Relay 1		
25	26	27	28	29	30

U_V		LAN_L		LAN_R		LON		Status			± U_H ≂		
+ 24V		+ EA	+ E	+ EA	+ E	A	B				L	N	
43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

U1603

Analog / SO																								Relay 1			Relay 1		
+ E1		+ E2		+ E3		+ E4		+ E5		+ E6																			
1	2	3	4	5	6	7	8	9	10	11	12													25	26	27	28	29	30

Analog				SO						U_V		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

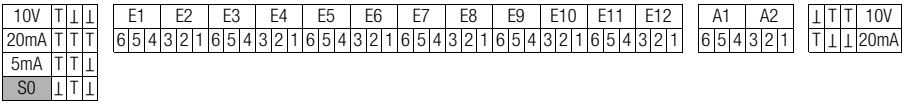
Terminal	Function	Designation
31	Output A1, analog	+
32	Output A1, analog	–
33	Output A2, analog	+
34	Output A2, analog	+
35	Output S1, binary (S0)	+
36	Output S1, binary (S0)	–
37	Output S2, binary (S0)	+
38	Output S2, binary (S0)	–
39	Output S3, binary (S0)	+
40	Output S3,, binary (S0)	–
41	Output S4, binary (S0)	+
42	Output S4, binary (S0)	–
43	Power, external contacts	+ 24 V
44	Power, external contacts	0 V
45	LAN **L**eft	EA+
46	LAN **L**eft	EA–
47	LAN **L**eft	E+
48	LAN **L**eft	E–
49	LAN **R**ight	EA+
50	LAN **R**ight	EA–
51	LAN **R**ight	E+
52	LAN **R**ight	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 / –

Note:
The meter power supply U_V provides max. 24 V DC at max. 0.15 A (short-circuit proof). Inputs E1 ... E12 can be configured as either analog or binary inputs (S0) – see chapter 7.2, page 52.

7.2 Input and Output Configuration (DIP switches)

Remove the cover plate at the top of the instrument. The analog inputs and outputs can be adapted to the desired measuring range, and can be configured as binary inputs (S0) with the DIP switches. These setting must also be entered to the channel data (I/O range parameter, see page 39).

U1601



DIP switches for analog inputs
S0 corresponds to binary input
Set at the factory to S0

DIP switches for analog outputs
Switching between voltage and current
Set to 20 mA at the factory

U1603

DIP switches for analog inputs
S0 corresponds to binary input
Set to S0 at the factory

DIP switches for analog outputs
Switching between voltage and current
Set to 20 mA at the factory

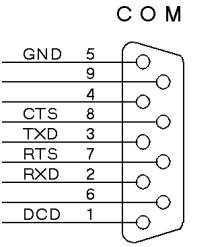
7.3 Interface Pin Assignments, Connector Cable

Cable type GTZ 5232 000 R0001 is required for connecting a summator to a PC. This is a 9-pole null modem cable with two socket connectors and a length of approximately 2 meters.

7.3.1 U1601

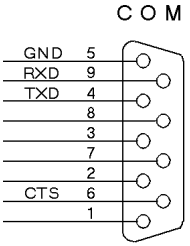
Pin Assignments for D9 Sub-Miniature Connector Plug for COM1

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



Pin Assignments for D9 Sub-Miniature Connector Plug for COM2

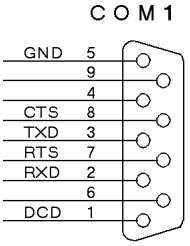
Pin Number	Function
1	
2	
3	
4	TXD
5	Signal - ground
6	CTS
7	
8	
9	RXD



7.3.2 U1602, U1603

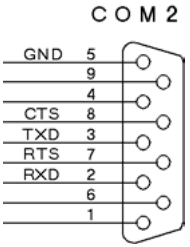
Pin Assignments for D9 Sub-Miniature Connector Plug for COM1

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



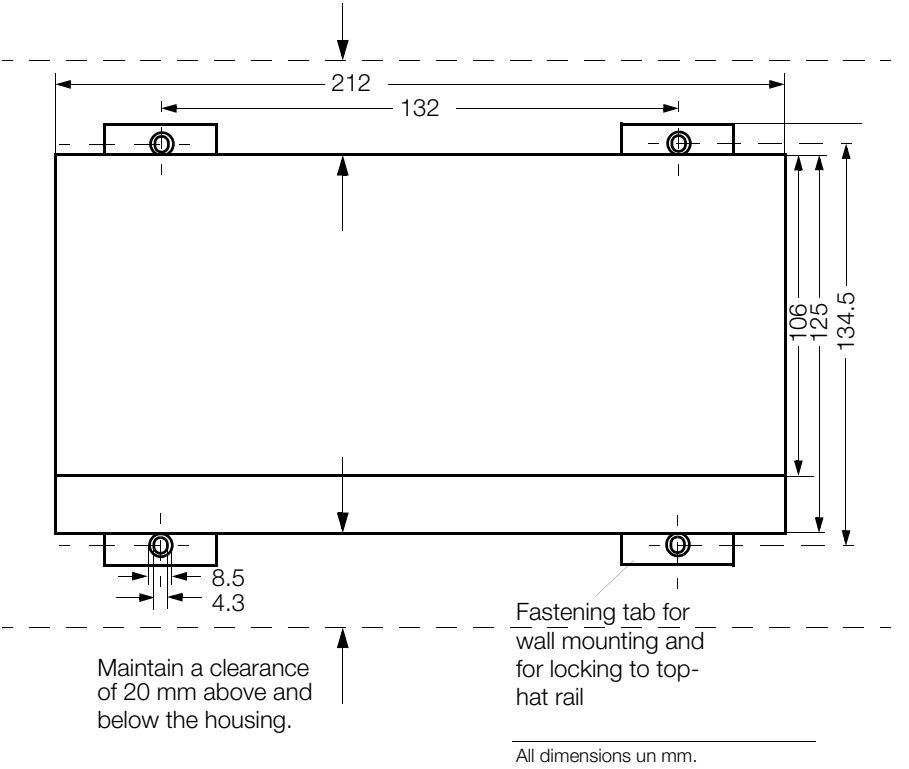
Pin Assignments for D9 Sub-Miniature Connector Plug for COM2

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



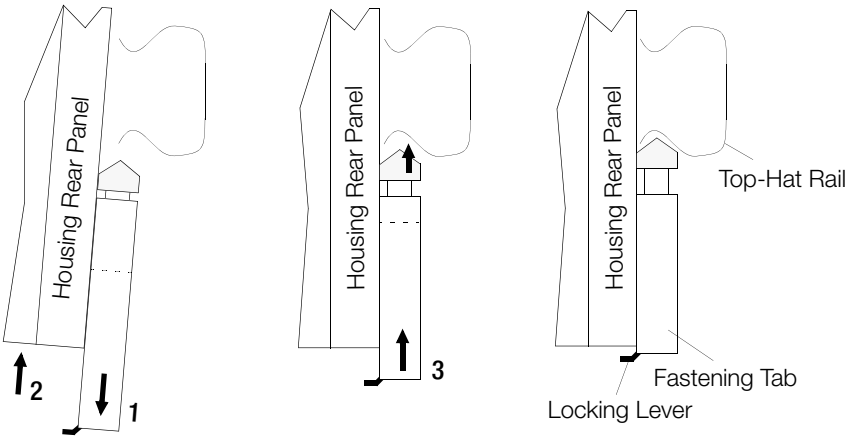
8 Meter Installation

Drill Hole Pattern

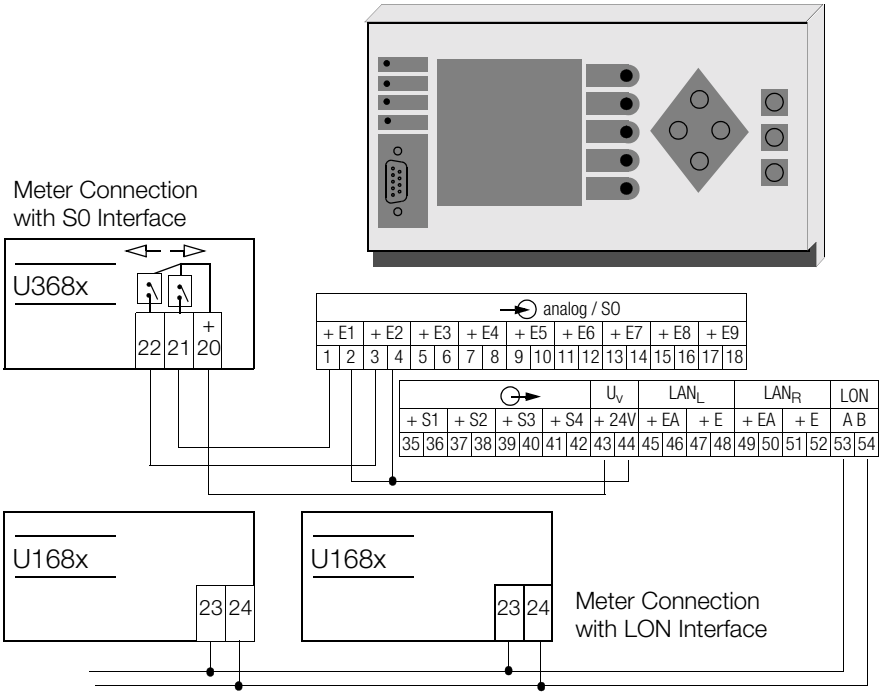


All dimensions un mm.

Installation to Top-Hat Rail



Meter Connection (example)



9 Programming

9.1 General Information

ECL - Energy Control Language

The flexibility of the ECS is based upon programmability of the individual summators using a programming language which was developed especially for the ECS, namely ECL or Energy Control Language. See ECL Interpreter operating instructions and command reference for more details concerning this high level language which is similar to FORTH, and which is just as easy to learn as BASIC. Thanks to its programmability, the following, additional system characteristics are made available:

Virtual Channels

Even complex formulas for the creation of virtual channels can be concisely and plainly formulated as background programs. No predefined patterns get in the was of flexibility.

Programming the Relays

Relay switching may depend upon a multitude of conditions. Any desired conditions, even conditions which effect more than one summator, can be formulated with ECL. These conditions are monitored continuously by a background program. A specialized type of relay output programming might even correspond to a simple form of energy management ...

Simple Energy Management

Example: If mean power at a given load component exceeds a specified value, the load component is switched off by activating one of the two relays. Whether or not this shut-down is desired at all can be determined by the system clock (e.g. nighttime only), by querying a binary input (e.g. only shut down if high level is applied to input 10) or by analyzing the power values of additional load components.

Tariff Selection

Highly specialized requirements for switching between tariffs can be fulfilled by means of time comparison functions with background programs.

Flexible Adaptation to Database-Specific Transmission Formats

Repetitive queries to the database can be set up as normal P programs. Complete ASCII oriented database formats can also be realized with this type of program. When the program is started, data transmission is performed in accordance with the desired format.

Background Programs H0 through H31

32 background programs, H0 through H31, are available. Each program can record up to 127 characters. The background programs are run continuously, one after the other. Due to the multi-tasking structure of the operating program, normal operating sequences are not effected at all by the background programs.

Programs P0 ... P31, Q0 ... Q31

64 programs, P0 through P31, or Q0 through Q31, respectively, record repetitive command sequences which can then be run simply by opening the corresponding program. Programs can be nested, and a normal P program can be run as a sub-program from a background program.

Program Names
Names can be assigned to P programs. P programs can be queried system-wide with the help of such names.

9.2 Parameters Configuration and Data Visualization at a PC

The easiest way to communicate with a summator from a PC is by means of terminal emulation, e.g. with the help of HyperTerminal. However, the user must be very familiar with the commands.

ECSwin provides a much more convenient method.
Program features:
ECSwin is used primarily for configuring parameters at U1600, U1601, U1602, U1603 and U1615 summators in an ECS LAN. Beyond this, reading in and visualizing energy consumption data in the form of measured value tables and graphics is supported as well. The program is available in a 16 bit version for MS Windows as of version 3.x, and in a 32 bit version for MS Windows as of Windows 95.
The following functions are provided by the software:

- A dialog box for logging on and configuring access authority
- A dialog box for setting time in the ECS LAN
- A dialog box for configuring summator parameters
- A dialog box for configuring channel parameters
- A dialog box for setting meter readings
- A dialog box for configuring relay parameters
- Transmit user created command sequences to the summator
- A dialog box for generating virtual channels
- Control panel display (including device display, keys and LEDs) for U1600 and U1601
- Ascertainment and graphic representation of the ECS LAN network topology
- Querying and display (as table or characteristic curve) of Intervalic, daily, monthly and annual energy and power data which have been stored to memory at the summator
- Querying and graphic display of current measured values in data logger format
- Data transmission via modem (maintenance of a dial-up list)
- Terminal emulation

10 Characteristic Values

- **Inputs E1 ... E12 (U1601, U1603)**

The 12 inputs can be configured individually as voltage, current or binary inputs with DIP switches (see page 52).

Analog Input (current)

Input quantity	direct current
Allowable Range of Input Quantities	–20 mA ≤ X ≤ 20 mA
Allowable Continuous Overload	≤ 2.5 X2
Upper Value (configurable)	1 mA ≤ X2 ≤ 20 mA
Max. Continuous Input	±1.25 X2
Input Impedance	
X2:20 mA	75 Ω
X2:5 mA	300 Ω
Input Wiring	see figure 1 for wiring diagram
Electrical Isolation	with optocoupler
Common-Mode Rejection (≤ 120 Hz)	≥ 80 dB

Analog Input (voltage)

Input quantity	direct voltage
Allowable Range of Input Quantities	–10 V ≤ X ≤ 10 V
Allowable Continuous Overload	≤ 30 V
Upper Value (configurable)	1 V ≤ X2 ≤ 10 V
Max. Continuous Input	±1.25 X2
Input Impedance	118 kΩ
Input Wiring	see figure 1 for wiring diagram
Electrical Isolation	with optocoupler
Common-Mode Rejection (≤ 120 Hz)	≥ 80 dB

Binary Input (S0)

Input quantity	direct voltage (square-wave pulse, S0 compatible)
Allowable Range of Input Quantities	signal level: H: 0.8 mA ... 4.8 mA L: 0 mA ... 0.4 mA
Allowable Overload	
Continuous	≤ 48 V
Intermittent (t ≤ 1 s)	≤ 60 V
Allowable Contact Types	semiconductor switching device, relay
Series Resistor (internal)	5.1 kΩ
Input Wiring	see figure 1 for wiring diagram
Electrical Isolation	with optocoupler
Pulse Duration T_{on}	≥ 50 ms
Interpulse Period T_{off}	≥ 50 ms
Pulse Frequency	≤ 10 Hz
Counting Range Limit	22 places of which 15 are usable

- **Outputs**

Analog Outputs A1 and A2 (U1601, U1603)

Type	floating
Number (DIP switch coded)	2
Current Output:	
Allowable Range	$-20\ mA \leq Y \leq 20\ mA$
Upper Value Y2 (linear parameters configuration)	$1\ mA \leq Y2 \leq 20\ mA$
Max. Output Voltage	$\leq 30\ V$
Max. Output Current	1.25 Y2
Load Range	$0 \leq \frac{5\ V}{Y2} \leq 10\ V/Y2$
Voltage Output:	
Allowable Range	$-10\ V \leq Y \leq 10\ V$
Upper Value Y2 (linear parameters configuration)	$1\ V \leq Y2 \leq 10\ V$
Max. Output Voltage	1.25 Y2
Max. Output Current	$\leq 40\ mA$
Load Range	$Y2/2\ mA \leq \frac{Y2}{1\ mA} \leq \infty$
Alternating Component	≤ 0.005 Y2

Binary Outputs S1 through S4 (U1601, U1603)

Type	floating
Number	4
Contact Type (DIN 43864)	MOS relay
Volume Resistance (AC/DC)	5 Ω
Output Voltage (external, passive)	$\leq \pm 50\ V$
Output Current	
ON	$\leq 200\ mA$
OFF	$\leq 10\ \mu A$

Relay Outputs, Relay 1 and Relay 2

Switching Element	relay
Number of Relays	2
Contact Type	changeover contacts
Switching Voltage	250 V~, 30 V=
Switching Current	8 A ohmic, 3 A inductive
Switching Cycles	$\leq 10^5$

Power Supply for External Switching Contacts

Voltage U_V (electrically isolated)	24 $V_{=}$
Voltage Tolerance	$\leq \pm 4\%$
Current (short-circuit and idling proof)	$\leq 0.15\ A$
Alternating Component (≤ 100 kHz)	$\leq 2\%\ V_{PP}$
Voltage Check	$\leq 16\ V_{=}$

• RS 232 Interface (PC / printer)

Number	1 (channel A and channel B)
Connectors	plug connector, 9-pin Sub-D
Possible Connections	
Channel A:	ECL, modem, terminal, radio-controlled clock
Channel B:	ECL, printer, radio-controlled clock, OFF
Data Bits	8
Transmission Speed	
Channel A/B:	1,200 ... 115,000 bits per second
Parity	none
Operating Mode	full duplex, handshake Xon/Xoff

• ECS LAN Interface (RS 485, for linking summators)

Number	2
Connectors	plug connectors with screw connection (up to 255 users)
Users per Segment	16 (32 with loop resistance < 100 Ω)
Operating Mode	multi-master, half duplex or full duplex
Data Protocol	HDLC/SDLC (adapted to multi-master requirements)
Topology (line and/or open ring)	≤ 1200 m open ring ≤ 100 m mixed
Transmission (hamming distance = 4)	15.6 ... 375 kBit/s
Status Display	2 LEDs
Terminal Resistor	switchable

• LON Interface (for connecting meters)

Number	1 (FTT-10, twisted 2 conductor cable)
Connectors	plug connectors with screw connection (up to 63 user per summator)
Operating Mode	LonTalk protocol (CSMA)
Topology	freely wired ≤ 500 m terminated bus ≤ 2700 m (cable type: Belden 85102, 1.3 mm diameter, 28 Ω/Km)
Transmission Speed	78 kbps
Status Display	1 LED, LON active
Bus Termination	switchable

• Display (U1601 only)

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

- **Measurement Value Storage**

Storage Mode	continuous
Memory Capacity, with 15 min. Interval	with 1 channel: 87,380 records with 64 channels: 3,971 records
Memory Stability	≥ 5 years with backup battery (see also aux. power supply – backup battery)
Resetting of Meter Values to Zero	via PC or keypad at instrument

- **Clock for Date and Time**

Smallest Time Unit	1 s
Allowable Deviation	10 ppm = 5.3 min. per year

- **Functions Monitoring**

Status Display	LED at front panel
Status Relay	changeover contact
Switching Voltage	250 V~, 30 V=
Switching Current	8 A ohmic, 3 A inductive
Switching Cycles	$\leq 10^5$

- **Influencing Quantities and Influence Errors**

Influencing Quantity	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
EMV Surge (severity level 3) (IEC 801-5)	2 kV

Test Voltages	
Input - Housing	0.5 kV
Input - Output	0.5 kV
Aux. Voltage - Input	3.7 kV
Input - Relay	3.7 kV

• Resistance to Climatic Conditions

Relative Humidity	75%
Temperature Ranges	
Operation / Function	–10° C ... +55° C
Storage, Transport	–25° C ... +70° C

• Auxiliary Power Supply

Extended 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
Backup Battery	
Lithium Cell (can be replaced without tools or data loss)	CR 2450
Service Life without Aux. Voltage at 20° C	≥ 5 years
Loss of Capacity after 5 Years with Aux. Voltage at 20° C	≤ 15%
Supply Voltage for External Circuits	
Voltage Range	direct voltage 24 V ± 4%
Overload Capacity	max. 0.15 A
Electrically Isolated	from all other circuits

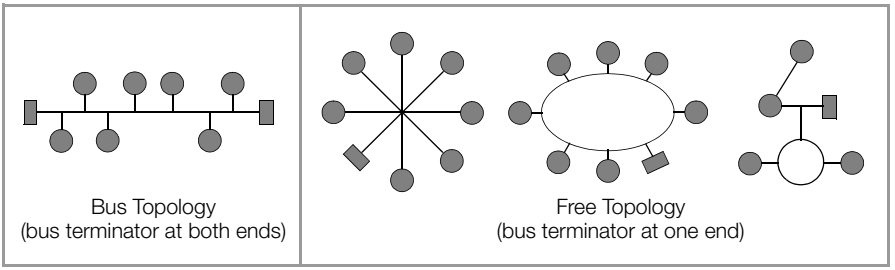
• Mechanical Design

Housing Material	aluminum sheet
Dimensions	212 mm x 125 mm x 85 mm
Installation Position	any
Mounting	mounting to top-hat rail per EN 50022/35 mm or screw mounted to plate
Protection	housing: IP 40 terminals: IP 20
Weight	1.6 kg
Terminals	screw terminals, max. 2.5 square mm
Protective Conductor	6.3 mm cable lug

11 LON Bus System Structure

The most commonly used transmission medium for industrial and building management applications is twisted pair copper cable, which is used together with the electrically isolated FTT-10A transceiver. Both of the conductors can be connected to either pole, and installation is thus reverse polarity protected.
Maximum transmission distances are influenced by the electrical characteristics of the cable, and the network topology. Utilized cables should comply with the stipulated specifications in order to prevent interference during communication. Due to the possibility of reflections, only one cable type may be used in any given bus segment.

Network Topologies:



If a bus structure is used, the components are connected in parallel, one after the other. A bus terminating resistor must be used at each end. Branch lines may not exceed a length of 3 meters. Only one bus terminator is required with free topologies, but transmission distances are limited in this case.
If repeaters are used, the bus signal can be boosted thus increasing maximum possible transmission distance. Due to response characteristics, only one passive repeater may be included in any given bus segment. The transition to other physical transmission media, and/or targeted forwarding of data packets to individual bus segments, is accomplished by means of routers.
The following recommendation is based upon experience gained by GOSSEN METRAWATT GMBH during installation and start-up of LON systems. The environment within which the cable is laid has a decisive influence on correct cable selection, and must therefore be taken into consideration during the planning stage. All generally applicable directives for laying control and telecommunications cables must be adhered to during installation.

11.1 Maximum Cable Lengths

Cable Type / Designation	Bus Topology (bus terminator at both ends)	Free Topology (bus terminator at one end)
JY (ST) Y 2 ea. 2 x 0.8 mm	900 m	500 m max. 320 m from device to device
UNITRONIC bus cable	900 m	500 m max. 320 m from device to device
Level IV, 22AWG	1400 m	500 m max. 400 m from device to device
Belden 8471	2700 m	500 m max. 400 m from device to device
Belden 85102	2700 m	500 m

Specified values apply to total cable length and are only valid for the FTT-10A transceiver.

11.2 Cable Type

Inexpensive wiring is possible for applications in environments with minimal interference using the following cable type: JY (ST) Y 2 ea. 2 x 0.8 mm with twisted wire pairs. The above specified dimension of 0.8 mm refers to the diameter of the wire, which results in a wire cross-section of 0.5 square mm.
In most cases no shielding is required. It may be possible to eliminate communications problems occurring in environments with excessive interference by connecting the shield at one end. If cables are used which contain several wire pairs, it may be advantageous if the individual pairs are shielded. Special LON bus cable can be used for highly demanding requirements.

11.3 Bus Termination

Additional bus terminators are required for bus topologies, and where repeaters are utilized. These can be purchased as auxiliary LON component U1664 in top-hat rail mount housing. Each unit includes a one-ended and a two-ended bus terminator.

12 Connecting LON Bus Compatible Devices

Up to 64 nodes can be connected to a U1601 summator via the LON network. The summator is capable of interacting with the following LON compatible devices:

- Multifunctional power meter A2000
- Programmable multi-transducer DME400
- Electric meters U1681, U1687, U1689
- 8-channel (S0) meter polling module U1660
- 6-channel analog input module U1661
- 6-channel relay output module OCL210

12.1 Network Interface

A so-called binding is generally required in order to enable communication amongst LON devices. This means that network variable outputs are linked (bound) to network variables inputs with the help of a tool.
Binding is not required for the U1601, which significantly simplifies installation. The nodes are addressed via the neuron ID (LON ID). The neuron ID is a twelve digit number which is printed on the device, and which can be queried via the display at the A2000. The channel function is configured with the mode command (CMODE). The desired values are selected with the sub-channel command (LonCHANNEL). Selected values and any error messages generated by the LON devices are queried cyclically (polling).

12.2 Functions

Acquiring Energy and Power Values (mode: LON, CMODE = 4 LON)

The U1601 continuously acquires meter readings and power values from the LON devices. A delta value is generated based upon the current meter reading and the previous value, which is added to Etot and Eint. The current meter reading is stored to non-volatile memory for use in generating the next delta value. Only positive delta values are taken into consideration.
Special feature for U1660 and U1661: These devices are not equipped with a non-volatile memory. If supply power to any given LON data logger is interrupted, it starts counting again from zero. Meter readings acquired after this point in time are smaller than the recorded energy value, and thus no delta value is generated. In order to assure that this energy is not ignored, the first value after a power failure is saved as the previous value, and is used as a basis for generating the next delta value.

Acquiring Analog Values (mode: LON-ANA, CMODE = 5 LonA)

LON device network variables can also be acquired as analog values. This operating mode is especially useful for the innumerable values read out by the A2000 and the DME400. Values are no integrated in this case.

Acquiring Analog Values with Integration (mode: LON-PE, CMODE = 6 L-PE)

If the analog value represents power, energy is calculated by means of integration.

Binary Inputs and Outputs

(mode: LON-INP, CMODE = 7 LonI or LON-REL, CMODE = 8 LonR)
Binary inputs can be queried with the U1660 meter polling module, and the OCL210 relay output module is capable of switching relays.

12.3 Device Descriptions

12.3.1 A2000 Multifunctional Power Meter

Energy and Power Function

Settings:

`CMODE k = 4 LON`. Desired energy is selected by means of the network variable number under LonCHANNEL. `LonCHANNEL k = Nv#`. The displayed unit of measure is the power unit of measure. Only the energy network variable is entered, and corresponding power is read out automatically.

Energy Values and Corresponding Power

Nv#	Name	Description	Nv#	Name	Description
51	NvoWHTotExpLT	Active energy export LT	27	nvoWatTot	Active power in the network
52	NvoWHTotImpLT	Active energy import LT	27	nvoWatTot	Active power in the network
53	NvoWHTotExpHT	Active energy export HT	27	nvoWatTot	Active power in the network
54	NvoWHTotImpHT	Active energy import HT	27	nvoWatTot	Active power in the network
58	NvoVarHTotExpLT	Reactive energy export LT	35	nvoVarTot	Reactive power in the network
59	NvoVarHTotImpLT	Reactive energy import LT	35	nvoVarTot	Reactive power in the network
60	NvoVarHTotExpHT	Reactive energy export HT	35	nvoVarTot	Reactive power in the network
61	NvoVarHTotImpHT	Reactive energy import HT	35	nvoVarTot	Reactive power in the network

Only the LTHT setting is supported by the A2000 (default status).

Analog Value Function

All other network variables can be read in as analog values.

Settings:

`CMODE k = 5 LonA`. The desired value is selected by means of the network variable number under LonCHANNEL.

`LonCHANNEL k = Nv#`. The displayed unit of measure is the power unit of measure.

12.3.2 DME400 Programmable Multi-Transducer

LON Settings:	Domain 1:	Length 1, ID 00
	Node state:	Configured, online

Energy and Power Function

Settings:

`CMODE k = 4 LON`. Desired energy is selected by means of the network variable number under LonCHANNEL. `LonCHANNEL k = Nv#`. The displayed unit of measure is the power unit of measure. Only the energy network variable is entered, and corresponding power is read out automatically.

Energy Values and Corresponding Power

Nv#	Name	Description	Nv#	Name	Description
51	Nvo_EnergyA	Active energy export	27	nvo_TrueSY_Power	Active power in the network
52	Nvo_EnergyB	Active energy import	27	nvo_TrueSY_Power	Active power in the network
53	Nvo_EnergyC	Inductive reactive energy	35	nvo_ReactSY_Pwr	Reactive power in the network
54	Nvo_EnergyD	Capacitive reactive energy	35	nvo_ReactSY_Pwr	Reactive power in the network

Only this setting is supported (must be configured).

Analog Value Function

All other network variables can be read in as analog values.
Settings:

`CMODE k = 5 LonA`. The desired value is selected by means of the network variable number under LonCHANNEL. `LonCHANNEL k = Nv#`. The displayed unit of measure is the power unit of measure.

12.3.3 U1681, U1687 and U1689 Electric Meters

Settings:

`CMODE k = 4 LON`. Desired energy is selected via LonCHANNEL. `LonCHANNEL k = 1` reads out active energy import, `LonCHANNEL k = 2` reads out active energy export. Corresponding power is read out automatically.

Energy Values and Corresponding Power

Nv#	Name	Description	Nv#	Name	Description
8	Nvo01EnergyInL	Active energy import	22	nvo02Power	Active power in the network
10	Nvo01EnergyOutL	Active energy export	22	nvo02Power	Active power in the network

12.3.4 U1660 8-Channel (S0) Meter Polling Module

Energy Meter Function

Settings:

`CMODE k = 4 LON`. The desired input is selected via LonCHANNEL. `LonCHANNEL k = 1...8` reads out the number of meter pulses from channels 1 through 8, from which energy is calculated by the summator. Corresponding power is calculated by the U1660 and read out automatically. The meter constant (Mconst) is transmitted to the device during installation to this end.

Binary Input Function

A U1660 meter polling module can be assigned to each of the channels of the U1601.

Settings:

`CMODE k = 7 LonI`. LonINP reads out the status of all 8 S0 inputs of the U1660. The energy meter function of the U1660 remains unaffected. Each input corresponds to one bit:

```
Input    8 7 6 5 4 3 2 1
Bit      8 7 6 5 4 3 2 1
```

Example: `LonINP 3 = 3` means U1660 at channel 3, inputs 1 and 2 on, all others off.

12.3.5 U1661 6-Channel Analog Input Module

Energy Meter / Flow Meter Function

Settings:

CMODE k = 4 LON. The desired input is selected via LonCHANNEL.
LonCHANNEL k = 1...6 reads out energy from channels 1 through 6. Corresponding power is calculated by the U1661 and read out automatically. The Pfactor, LonFACTOR and LonOFFSET parameters are transmitted to the device during installation to this end.

Analog Value Function (instantaneous power)

Settings:

CMODE k = 5 LonA. The desired analog value is selected via LonCHANNEL.
LonCHANNEL = 1...6 reads out analog values from channels 1 through 6. The Pfactor, LonFACTOR and LonOFFSET parameters are transmitted to the device during installation.

Power Function via LON, Energy Calculation in the U1601

Settings:

CMODE k = 6 L-PE. Desired power is selected via LonCHANNEL.
LonCHANNEL = 1...6 reads out analog power from channels 1 through 6. Corresponding power is calculated by the U1601. The Pfactor, LonFACTOR and LonOFFSET parameters are transmitted to the device during installation.

12.3.6 OCL210 6-Channel Relay Output Module

An OCL210 relay module with 6 relays can be assigned to each channel of the U1601.

Settings:

CMODE k = 8 LonR. Each relay corresponds to one bit:

```
Relay         6 5 4 3 2 1
Bit       8 7 6 5 4 3 2 1
```

Example: LonREL 2 = 5 switches relays 1 and 3 on at channel 2 in the OCL210, all other relays are off.

12.4 Reinstalling a LON Device

The following actions are executed when a LON device is installed:

– Find a bus user based upon the entered neuron ID.
– Read out device type.
– Assign net variables to be read in to a summator channel. Each multi-channel device has only one neuron ID. The channel is selected with the sub-channel parameter.
– For U1660 and U1661: Transmit parameters to the device.
– For energy metering (MODE = LON): Start delta value generation, i.e. the first value is saved as previous value energyOld. Delta value = energy – energyOld. Energy values recorded previously by the LON device are not taken into consideration.

Reinstallation of a LON channel is initialized with the LonNEW c = 1 command, or by changing the neuron ID. Reinstallation of all LON channels is initialized with the command:
LonNEW ** = 1 or via SETUP / LON / INSTALLATion

12.4.1 Preparing the Summator

Set bus termination at the control panel:
SETUP / LON / TERMINATION = 50 Ohm (SetLON = RA50)
LON network termination is set via TERMINATION:

TERMINATION = open	in case of external termination
TERMINATION = 50 Ohm	with free topology
TERMINATION = 100 Ohm	with bus topology using two terminators (branch lines < 3 m).

12.4.2 Preparing the LON Device

Connect the LON terminal at the LON device to the summator.
Connect operating power to the LON device.

12.4.3 Configuration via the Summator Control Panel

- Configure the summator channel:
  LON activity = STOPPED
  Set the channel mode: MODE = LON (or LON-ANA, LON-PE, LON-INP, LON-REL)
  Enter the sub-channel.
  Enter the neuron ID of the LON device.
  Enter and/or check all other channel parameters.
  LON activity = RUN
- If the summator finds the device, the device type is displayed in the left column.
  U1661.6 indicates a U1661 device with 6 channels.
  Parameters are transmitted to the device, and are read back in the case of the U1660 and the U1661.
  U1660: Check METER CONSTANT.
  U1661: Check LONFACTOR, LONOFFSET and P-FACTOR.
- Check LON type.
  If the type is displayed correctly: Check for channel errors.
  Installation is now complete.

If the connected device is not displayed at LON type: Check the LON ID.
If LON type is ??????.?: Check the LON ID, and check LON wiring.

Start reinstallation:
By changing the neuron ID. For example, set the first digit to 1, and then back to 0.
Reinstallation of all channels can be initialized via SETUP / LON / INSTALLATion.
Repeat this procedure until the device type is recognized.

12.5 Configuration at a PC with ECSwin Software

- Log on to the desired summator at the terminal.
- Access the “Configure / Channel parameters” menu function.
- Wait until all data have been read in.
- Enter all parameters to the “Meter inputs” index register.
  - MConst is transmitted to the device for the U1660 (double check).
  - P-FACTOR is transmitted to the device for the U1661 (double check).
- Enter all parameters to the “LON parameters” index register.
  - The LON factor and LON offset parameters are transmitted to the device for the U1661, (double check).
- Transmit data to the summator.
- Data are read back automatically and the LONtype column is filled in (this column has read-only access). Due to the fact that type recognition via the LON bus takes several seconds, “???????.?” is sometimes displayed as a type designation. The channel parameters window should then be exited and reopened.
- Check LON type.

If the type is displayed correctly: Check for channel errors.
Installation is now complete.

If the connected device is not displayed at LON type: Check the LON ID.
If LON type is ??????.?: Check the LON ID, and check LON wiring.
Start reinstallation:
Use the following command for a single channel: LonRE c = 1 in terminal window
Use the following command for a all channels: LonRE ** = 1
Repeat this procedure until the device type is recognized.

12.6 Replacing a LON Device

- Deactivate the affected summator channel
  (control panel: MODE = OFF; ECSwin: CMode = 0).
  Deactivate all affected channels for multi-channel devices.
- Replace the LON device.
- Enter a new LON ID.
- Reactivate all deactivated channels
  (control panel: MODE = LON; ECSwin: CMode = 4).
- Check LON type.
  If the type is displayed correctly: Check for channel errors.
  Replacement is now complete.

If the connected device is not displayed at LON type: Check the LON ID.
If LON type is ??????.?: Check the LON ID, and check LON wiring.

Parameters are transmitted to the device in the case of the U1660 and the U1661. Check for parameters configuring errors. Control panel: CHANNEL ERROR menu, terminal: ErrChan c

If a parameters configuring error is detected:

For U1660: Check METER CONSTANT

For U1661: Check LONFACTOR, LONOFFSET and P-FACTOR.

Start reinstallation:

At the control panel: by changing the neuron ID. For example, set the first digit to 1, and then back to 0.

Reinstallation of all channels can be initialized via SETUP / LON / INSTALLATion.

At terminal window: For one channel with the following command `LonRE c = 1`

For all channels with the following command `LonRE ** = 1`

Repeat this procedure until the device type is recognized.

12.7 Additional LON Parameters

- Waiting time for responses:
  SETUP / LON / TIMING CODE = 9 (`LONSTATTIMing = 9`)
  Waiting time is set for a response with TIMING CODE.
  TIMING CODE is an encoded value for the duration of time allowed between a query and a response. The default setting (9) should only be changed by experts!

TIMING CODE	Waiting time in ms
LONSTATTIMing	
0	16
1	24
2	32
3	48
4	64
5	96
6	128
7	192
8	256
9	384
10	512
11	768
12	1.024
13	1.536
14	2.048
15	3.072

- Time between two queries:
  A delay can be selected here in order to reduced data traffic in the bus.
  SETUP / LON / POLL DELAY = 0 (`LonPOLLDELay = 0`)
  POLL DELAY is time between queries from 2 channels in milliseconds.
  Example: POLL DELAY = 300, 60 channels: all channels are queried in 18 seconds.
  Default: POLL DELAY = 0, 60 channels: all channels are queried in 5 seconds.

12.8 Channel Errors

The following channel errors may occur depending upon the type of installed device:

Bit	U1601 Description	A2000	DME400	U1660	U1661	U1681	U1687	U1689	OCL210
1	COM2 communications error	✔	✔	✔	✔	✔	✔	✔	✔
3	Self-test error	✔				✔	✔	✔	
6	Off-line	✔	✔	✔	✔	✔	✔	✔	✔
9	Broken sensor				✔[1)]				
10	Phase failure						✔	✔	
11	Phase sequence error	✔						✔	
12	Overflow	✔			✔	✔	✔	✔	
25	Parameter config. error			✔	✔				

[1)] Only for U1661 B2 4 - 20 mA

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14 Maintenance, Repair, Product Support

Maintenance

The integrated backup battery (MnO_2-Li button cell) can be replaced with the help of the cover plate at the top of the instrument. The cover plate must first be removed. The rounded end of the plate and its 90° angle tab are designed to accommodate the battery. After laying the plate onto the button cell and snapping the tab into place, the battery can be removed by gently pulling on the plate.
The new button cell (only type CR2450 batteries may be used) can then simply be inserted gently into the battery compartment.
Attention: Only use the cover plate designed for this purpose to remove the battery, and do not insert the plate into the housing next to the battery!

Repair and Replacement Parts Service
DKD Calibration Lab and Rental Instrument Service

If required please contact:

GOSSEN METRAWATT GMBH
Service Center
Thomas-Mann-Strasse 16 - 20
90471 Nürnberg, Germany
Phone +49 911 86 02 - 410 / 256
Fax +49 911 86 02 - 2 53
e-mail service@gmc-instruments.com

This address is only valid in Germany. Please contact our representatives or subsidiaries for service in other countries.

Product Support

If required please contact:

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