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GOSSEN METRAWATT SU1604 Summation Transformer Instruction Manual

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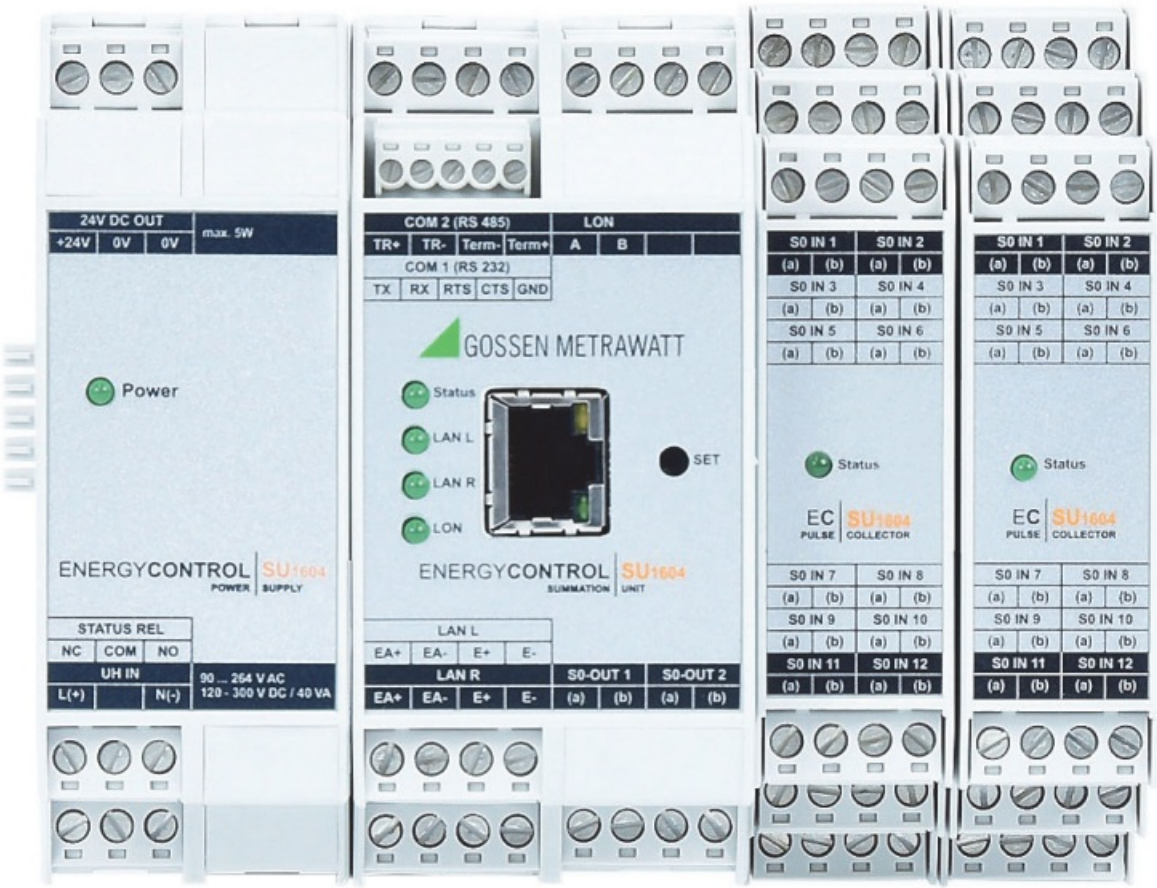
Instruction Manual



ENERGYCONTROL SU1604
Summator

Contents

1 SU1604 Summation Transformer
2 Safety Instructions
3 Applications
4 Introduction
5 Device Description
6 Measurement Data
7 Operation (display menus)
8 Basic Configuration
9 Terminal Assignments
10 Programming
11 Technical Data
12 LON Bus System Structure
13 Maintenance
14 Contact, Support and Service
15 Returns and Environmentally Sound Disposal
16 Documents / Resources
16.1 References

SU1604 Summation Transformer

Highlights

- New modular concept
- Software is downward compatible to U1600/1/2/3 summators
- Energy Control Language (ECL) for programming analyses, monitoring and optimization

U1604 basic module:

- **64 processing channels** for calculating energy, power and costs. Physical inputs (up to 64) or LON meters can be allocated as desired.
- **Increased processing power** by a factor of 10 to 15 as compared with U1601/2/3 summators
- **LON interface for** 64 LON devices
- **One RS 232 interface** (max. 921 kBaud)
- **One RS 485 interface** (max. 921 kBaud, half-duplex)
- **Two ECS LAN interfaces** (max. 375 kBaud)
- **Ethernet interface** (100 MBit/s) with ECL access via TCP/IP

Further optional components:

- **U1614 power pack module with status relay**
- **U1624 SO input module** with twelve S0-compatible meter inputs (up to 6 modules, max. 64 S0 inputs)

Scope of delivery, SU1604
1 U1604 basic module
1 Split toroidal core
2 ME 22.5 T-bus mounting rail connector
1 Condensed operating instructions

Scope of delivery, SU1614
1 U1614 power pack module
2 ME 17.5 T-bus mounting rail connector
1 Condensed operating instructions
Scope of delivery, SU1624
1 U1624 pulse recording module
1 ME 22.5 T-bus mounting rail connector
1 Condensed operating instructions

Safety Instructions

Observe this documentation, in particular all included safety information, in order to protect yourself and others from injury, and to prevent damage to the instrument.

- Carefully and completely read and adhere to these operating instructions, as well as the instrument's condensed operating instructions. The respective documents can be found at http://www.gossenmetrawatt.com.
- Retain these documents for future reference.
- Observe the five safety rules in accordance with DIN VDE 0105-100:2015-10, VDE 0105-100:2015-10, Operation of electrical installations – Part 100: General requirements (1. Shut down entirely. 2. Secure against restart. 3. Assure absence of voltage at all poles. 4. Ground and short circuit. 5. Cover neighboring live components, or make them inaccessible.).
- Observe and comply with all safety regulations which are applicable for your work environment.
- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.
- Use the instrument in undamaged condition only. Inspect the instrument before use. Pay particular attention to damage. Damaged components must be replaced immediately.
- If the instrument or its accessories don't function flawlessly, permanently remove the instrument/accessories from operation and secure them against inadvertent use.
- Do not use the instrument and its accessories after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).
- Only use the instrument and its accessories within the limits of the specified technical data and conditions (ambient conditions, IP protection code, measuring category etc.).
- A suitable surge protector must be used in order to ensure that the installation site meets the requirements specified for overvoltage category II.
- The terminals of the U1614 power pack module may only be disconnected or connected in the current/voltage-free state!
- During operation when auxiliary power is active, the U1614 power pack module may not be mounted to or removed from the TBUS!
- During operation when auxiliary power is active, neither the U1614 basic module nor any other S0 modules may be mounted to or removed from the TBUS.
- Opening the housing of the U1614 power pack module during operation is impermissible! If replacement of the fuse should become necessary, for which the housing must be opened, all terminals must first be disconnected!
- The TBUS may only be used to connect ECS components – any combination with non-system devices with similar backplane connection is impermissible.

Applications

Please read this important information!

2.1 Intended Use / Use for Intended Purpose

The Energy Control System **(ECS)** is used to ensure transparent cost center accounting. All electrical and non-electrical energy media can be logged, optimized and billed to the respective cost centers.

As a central device within the Energy Control System (ECS), the U1604 summator makes it possible to log and bill analog and digital quantities.

These operating instructions describe ECS operating software as of V3.00.

Current operating instructions for the latest firmware update are available for download at **www.gossenmetrawatt.com**.

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2.2 Use for Other than Intended Purpose

Using the instrument for any purposes other than those described in the condensed operating instructions or these instrument operating instructions is contrary to use for intended purpose.

2.3 Liability and Guarantee

Gossen Metrawatt GmbH assumes no liability for property damage, personal injury or consequential damage resulting from improper or incorrect use of the product, in particular due to failure to observe the product documentation. Furthermore, all guarantee claims are rendered null and void in such cases. Nor does Gossen Metrawatt GmbH assume any liability for data loss.

2.4 Opening the Instrument / Repairs

The instrument may only be opened by authorized, trained personnel in order to ensure flawless, safe operation and to assure that the guarantee isn't rendered null and void.

Even original replacement parts may only be installed by authorized, trained personnel.

Unauthorized modification of the instrument is prohibited.

If it can be ascertained that the instrument has been opened by unauthorized personnel, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.

Introduction

The new modular concept of the U1604 permits space-saving setup of an ECS Energy Control System in accordance with actual requirements.

Thanks to strict software compatibility with the earlier U1601/2/3 summators and downward compatibility to the U1600 summator, previously used systems can be easily replaced or expanded.

An instrument can be set up using the following modules:

- U1604 basic module with the following interfaces:
- 1 ea. RS 232 (COM-1), 1 ea. RS 485 (COM-2), ECS LAN left + right, LON, 2 ea. S0 relay output
- U1614 power pack module with status relay for supplying power to all components via the TBUS and an additional 24 V DC output (max. 5 W) – overall output power amounts to 20 W
- U1624 S0IN12 input module with 12 S0-compatible inputs (up to 6 modules, max. 64 S0 inputs)

Connector Terminals

All signals are fed to the instrument via screw terminals which can be unplugged (3, 4 or 5-pole). This assures trouble-free replacement in the event that servicing is required.

TBUS

The individual components are connected to each other via the so-called TBUS. The TBUS is laid out as a 5 conductor system and distributes 24 V DC supply power and signals from the TBUS communications interface (RS-485) to all components. The fifth conductor is used to indicate device status. One or two corresponding TBUS adapters are included with each U1604 component. These TBUS adapters (width: 17.5 or 22.5 mm) are snapped into the DIN top-hat rail in the fully assembled state before mounting the devices. Please note: The U1614 power pack module with an overall width of 35 mm requires two 17.5 mm TBUS adapters, and all other devices require one or two of the 22.5 mm TBUS adapters.

3.1 Summator Comparison

The following table provides an overview of the hardware features included with the various ECS summators:

Hardware Feature	U1604	U1601/2/3	U1600
Modular concept with TBUS	✔	—	—
COM-1 (RS 232)	Max. 921 kBd	Max. 115 kBd	Max. 38.4 kBd
COM-2 (RS 232)	—	✔1 /✔/✔ Max. 115 kBd	(✔) 2 Max. 9600 bd
COM-2 (RS 485)	Max. 921 kBd	—	—
ECS LAN (L+R)	Max. 375 kBd	Max. 375 kBd	Max. 125 kBd
LON	✔	✔	—

Hardware Feature	U1604	U1601/2/3	U1600
TCP/IP (10/100 Mbit/s) COM-4 COM-5	Port 5004 Port 500 5	—	—

S0 compatible meter inputs with U1624 mod ule (12 S0 ea.)	0 Max. 64	0 3 —	24 —
Analog inputs (20 mA, 10 V, S0)	0	12 / 0 / 6	—
Analog outputs	—	2 / 0 / 2	—
Status relay (250 V AC, 3-pole)	✔ To U1614	✔	✔
Relay (250 V AC, 3-pole)	—	2 / 0 / 2	4
S0 relay (semiconductor relay)	2	4 / 0 / 4	—
RAM Type	4 MB MRAM 4	1 MB SRAM	128 kB / 512 kB 5 S RAM
Flash memory Type	—	2 MB Flash	512kB EPROM
RTC real-time clock (with backup battery) 6 A ccuracy	5 ±5 ppm (0 … +10 ppm)	±20 ppm	±10 ppm

1. COM-2 only available for U1601 with splitter cable

2. COM-2 for U1600 with splitter cable only and only usable for DCF radio controlled clock module or character output (printer)
3. Analog inputs can be used as S0 inputs (U1601 + U1603)
4. As opposed to SRAM, MRAM does not required a backup battery for data retention
5. U1600 without/with memory expansion
6. Accuracy of → 10 ppm → RTC gains (+) or loses (-) no more than roughly 0.8 s per day

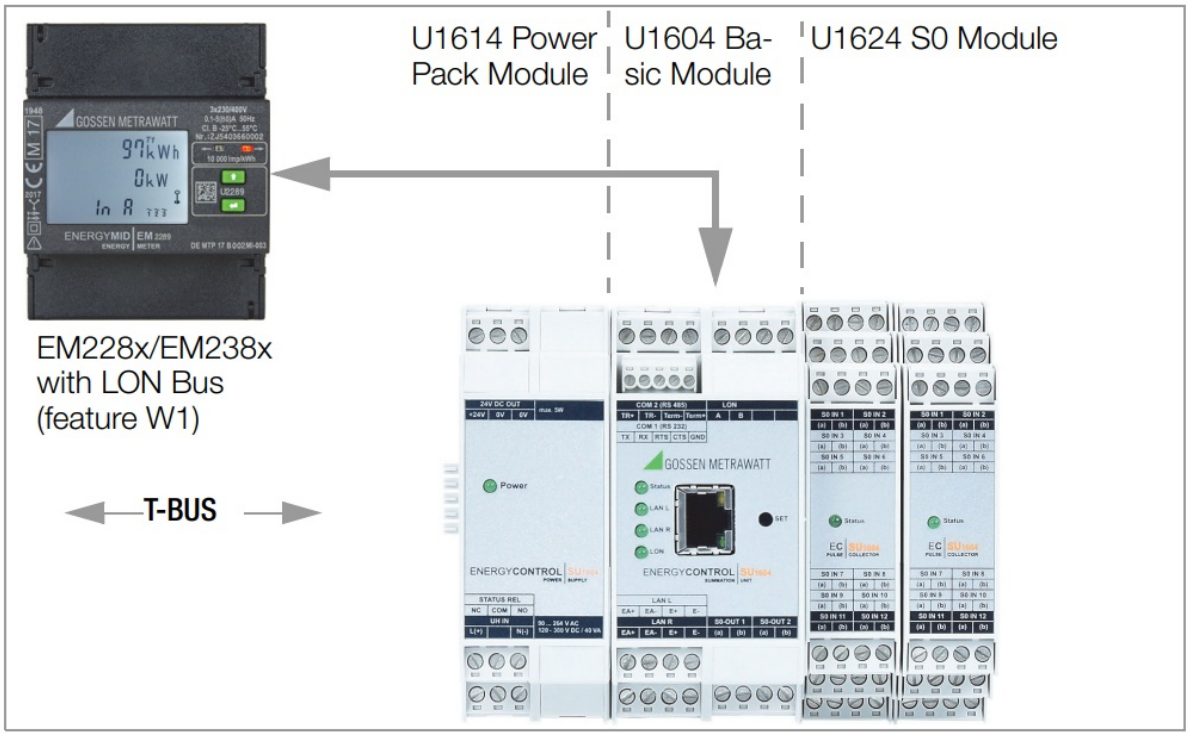
   The following table provides an overview of the software features included with the various ECS summators:

Software Feature	U1604	U1601/2/3	U1600
ECS operating system	ECS V3.xx	ECS V2.xx	ECS V1.xx
Number of energy channels	64 (1 … 64)	64 (1 … 64)	32 (1 … 32)
Background programs P programs Q programs A variable (double) B variant (double)	32 (H 0…31) 32 (P 0…31) 32 (Q 0…31) 64 (A 0…63) 64 (B 0…63)	32 (H 0…31) 32 (P 0…31) 32 (Q 0…31) 64 (A 0…63) 64 (B 0…63)	32 (H 0…31) 32 (P 0…31) — 32 (A 0…31) —
EINT measurement data list Recording duration, 32 channels Recording duration, 64 channels	768 KB 120.5 days 62.1 days	512 KB 80.3 days 41.4 days	64 KB / 448 KB [7] 10.0 / 70.3 days 5.2 / 36.2 days
UDM – user definable menus [8]	✔	—	—

7. U1600 without/with memory expansion
8. UDM – user definable menus: for the implementation of extensive user-specific menus and applications (as of August 2017)

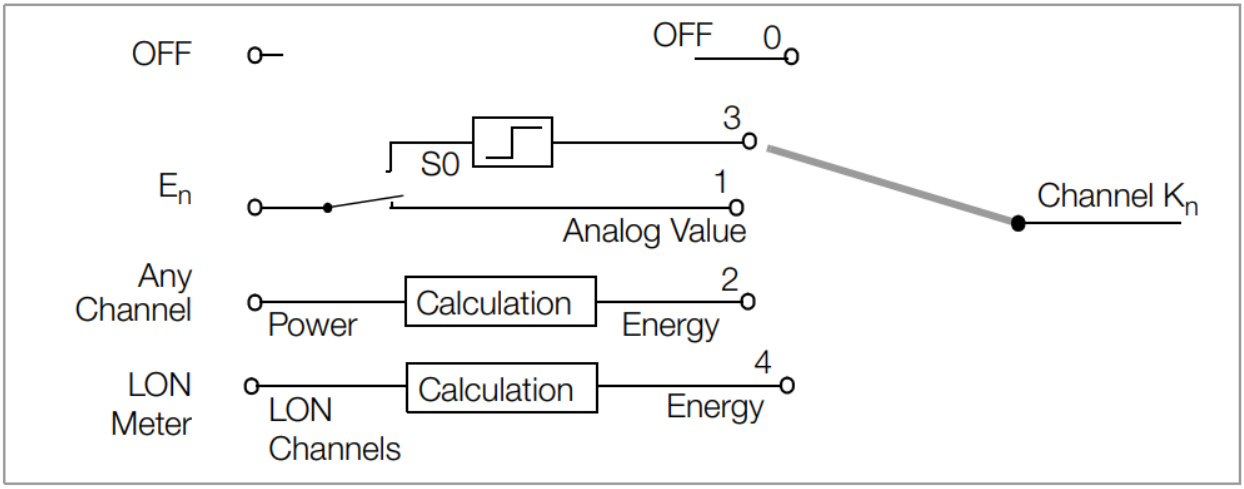
Device Description

4.1 U1604 Device Overview



4.2 Channels/Calculations

64 software channels are available. In the basic configuration, the type of input for these channels can be specified via the CMODE channel parameters (0 → 4).



Cyclical Generation of all Channel Registers

Due to the fact that each channel has numerous energy data registers (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 conducted continuously, and the less important ones in accordance with a rotating schedule. For example, Etot is ascertained continuously but Emon-12 only infrequently (roughly every 30 ……90 seconds). Power values other than Pmom are always calculated from energy values and thus don't have to be totaled up.

Channel Names

A name can be assigned to each channel which can have a length of up to 8 characters. The channel can be better identified for data processing and display purposes with the help of this name. The name also makes it possible to access a specific channel per program system-wide.

```
<A> Etot Motor5
```

From summator A: a channel with the name "Motor5" is searched for system-wide and this channel's total energy is displayed (see also ECL command: FINDER).

Virtual Channels

- Each unused channel is available as a virtual channel, in order to generate any desired sums or differences from physical inputs or other virtual channels. It doesn't matter which summators the channels are assigned to within the ECS LAN system!
- Unused physical channels can also be used as virtual channels, in which case even the maximum value registers of the corresponding physical channel are available.
- The synchronizing-interval measurement data list can record data from virtual channels.

Differential Coupling (ECL commands dVSUM and dVIRT)
As of the moment of definition, incoming energy quanta (~ meter pulses) from the source channels are continuously summed up, and the summed up energy quanta are fed to the virtual channel as if they had actually just been measured. The virtual channel is thus decoupled from the source channels and data can be changed as desired. Application: logical coupling of the input signals (as if the corresponding input signals were connected to a single meter channel).

Example 1
Channel 26 at summator D: generates a cost center consisting of channels 1 → 5 + 8 of summator B: weighted at 0.7 and channel 4 of summator C: weighted at 0.3

H 1 = 'B:DVSUM 1 .. 5+8 0.7, C:VSUM 4 0.3, D:VI

Example 2
Channel 10 is equal to the balance of channels 1 → 8 and the total sum of channel 9 (sum 1 → 8 minus channel 9)

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

Numeric Range
In order to achieve greatest possible accuracy, all internal calculation operations are conducted with 64-bit floating point numbers. As a result, 15 (!) significant decimal places are available.

Switching the Channel Display On/Off
The on/off function only determines whether or not a channel is present at the display when scrolling through channel data or in a read-out with "*" (ECL command: ONOFF).
Otherwise, the channel's function is not influenced in any way.

Start/Stop Channel
The acceptance of an input's meter pulses is controlled with the start/stop function (ECL command: STARTSTOP).

- A channel generated with "differential coupling" can be influenced by means of an analog signal with the start/stop function.
- Due to the fact that a channel's binary input status is not influenced, this function can be used, for example, to avoid undesired counting of binary information.

Energy Metering
Meter pulses filtered in this way are integrated per channel in a temporary meter. Roughly once every 1 to 2 seconds, the meter values are converted to the corresponding energy values and the total energy registers are counted in as well. Pulses are converted to energy values in accordance with the following formula:

Energy Calculation

$$\text{Energy}[\text{kWh}] = \frac{\text{Pulses [Imp]}}{\text{Meter Constant}\left[\frac{\text{Imp}}{\text{kWh}}\right]} \times U_{ratio} \times I_{ratio} \times \text{Kfactor}$$

where:

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

Electrical Power Billing

Instantaneous power is determined on the basis of the intervals between the incoming pulses. All other power values are calculated from the corresponding energy value in consideration of the respective time interval.

By default, the calculation of power is based on an energy unit of measure per hour (kWh). In the case of other frames of reference (e.g. liters per minute,) the P factor must be correspondingly adjusted (ECL command: PFACTOR). The standard value is 3600, and for the liters per minute example it would be 60.

Formula for calculating power from energy E and timespan dt:

P = E * Factor / dt

Only sensors which are connected via the LON network deliver already calculated power and energy values to the summators.

4.3 Inputs

Binary Meter Inputs

Twelve S0 inputs are available per S0 module (U1624).

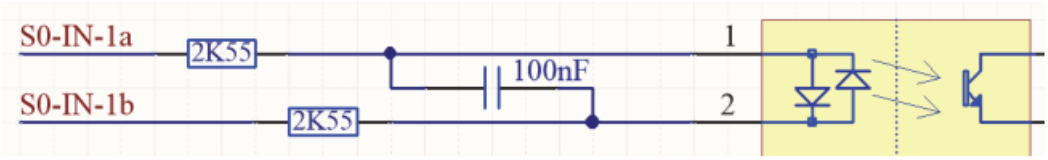
S0 IN 1	SO IN 2
(a) | (b)	(a) | (b)
SO IN 3	SO IN 4
(a) | (b)	(a) | (b)
SO IN 5	SO IN 6
(a) | (b)	(a) | (b)
U1624	
S0 IN 7	SO IN 8
(a) I (b)	(a) I (b)
SO IN 9	SO IN 10
(a) I (b)	(a) I (b)
SO IN 11	SO IN12
(a) I (b)	(a) I (b)

SO IN 1 … 12

– Six 4-pole connector terminals for two S0 inputs each.

– S0 input characteristics:

Input voltage = max. 30 V, input resistance = 5.1 kΩ, bipolar, electrically isolated
– Due to the fact that the utilized optocouplers are bipolar, connection polarity is irrelevant.



Debounce Time and Counting Edge
Debounce time and the counting edge (trigger edge) can be separately configured for each of the 12 inputs. Sampling time over all of the up to 12 channels amounts to 1 ms.

- Debounce time is adjustable from 0 ms to 20 s in 1 ms steps, ECL command: PULSE
- "+" (1) counting edge: Counting when change occurs from level 0 to level 1, ECL command: EDGE
- "-" (0) counting edge: Counting when change occurs from level 1 to level 0

  If an input is used as a binary input, the selected debounce time applies to this operating mode as well. For example, if a debounce time of 1 s has been selected, only signals which remain stable at the "1" or "0" level for at least 1 second are further processed.

  The input status display at the control panel shows only the debounced signal levels.

4.4 S0 Outputs S1 … S2
The two freely programmable S0 outputs make it possible to transmit messages in the event that certain conditions occur. Switchable voltage is limited to 50 V in this respect. Furthermore, the outputs can also be used as floating pulse outputs for remote transmission of meter values with the help of ECL background programs (see ECL command S0REL 1 … 2).

4.5 Self-Test
As long as the electronics are functional and no system errors have been detected, the status LED and the status relay are on. If an error has occurred at the device electronics, the relay drops out and the LED goes out. A horn, which can be controlled with the status relay's NC contact, is then able to indicate the error status. The current relay status is displayed in the status window (section 6.8 on page 29).
The function test can be expanded by means of appropriate programming (ECL com-mand: STATCHECK, further information in the online help via ? STATCHECK). For example, the output can already be deactivated (error status) when available 24 V supply power drops to below 16 V, or when the status of the lithium battery no longer assures reliable data retention.

4.6 RS 232/485 Port
Communication with the host PC, radio controlled clock, terminal, COM server, modem or printer is made possible by the RS 232 serial port.

Access to All Measurement Data
A PC connected to the RS 232 port has full access to all of the system's stored measured values. ECSwin parameters configuration software running at a PC manages all ECS data and permits tabular data evaluation.

Connection Configuration
The RS 232 port is laid out with the DTE (data terminal equipment) configuration and the signals are available at a 9-pole D-sub plug connector. This DTE configuration corresponds to the same one that is commonly used for PCs and terminals. Refer to section 8 on page 55 concerning connector cable wiring.

4.7 Ethernet Port
In addition to the COM-1 and COM-2 ports, ECL inputs via TCP/IP are available as well (see section 7.10 on page 49).

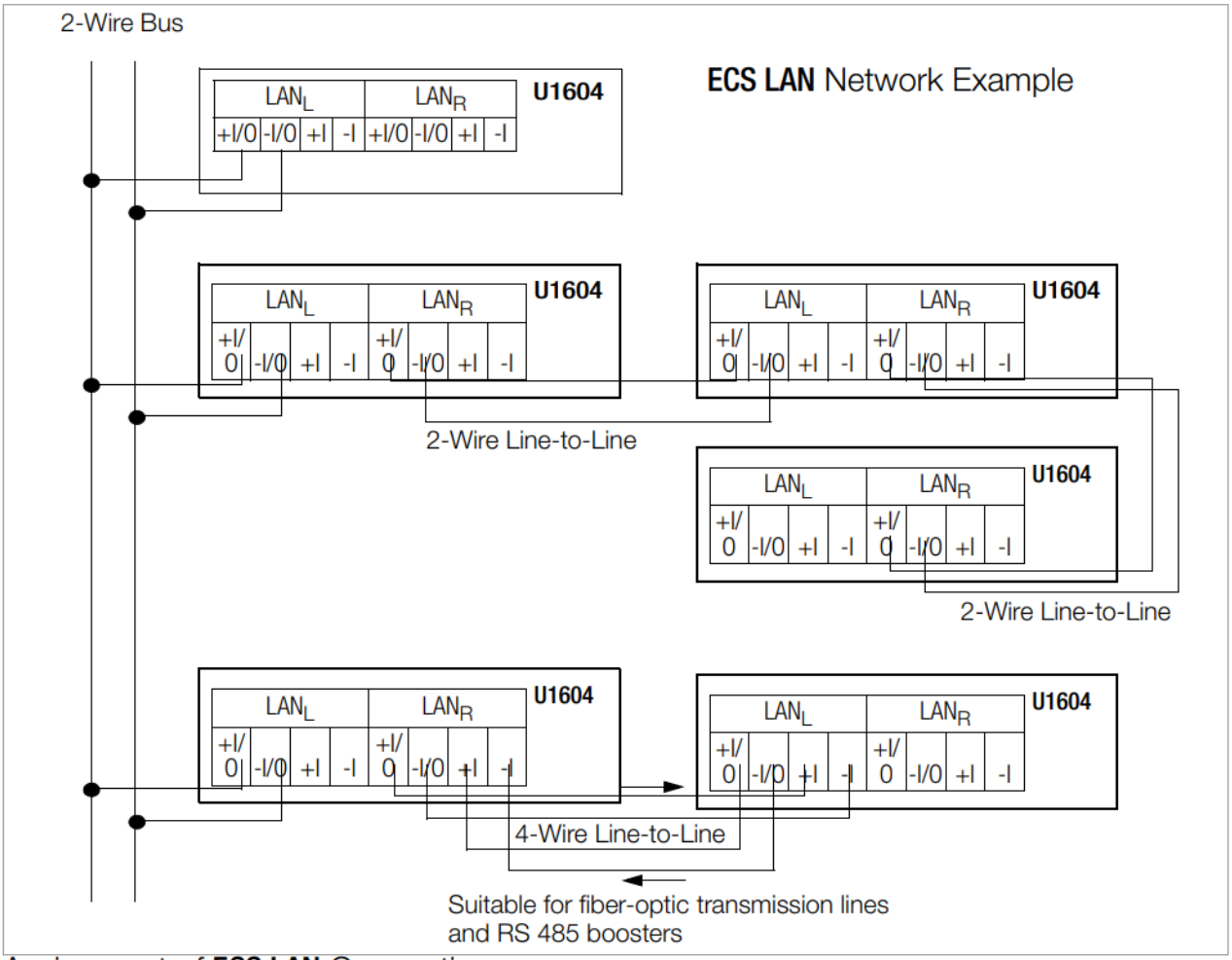
4.8 ECS LAN
For applications which necessitate the use of more than 64 channels, several summators can be connected to each other via a multi-master-compatible RS 485 fieldbus (ECS LAN). Linking can be conducted by means of a 2-wire cable with bus or line structure.
Maximum length per segment is 1200 m. Distances of several kilometers between 2 summators can be spanned with fiber-optic transmission lines based on 4-wire technology.
Up to 255 summators can be connected to the ECS LAN. And thus a maximum distance of roughly 300 km can be spanned without an additional booster.

Multi-Master System Architecture
The essential advantage of multi-master architecture results from the fact that each of the connected bus users has full access to the overall system's data and functions. This means that it's not necessary to select a single summator as the bus master.

General Information Concerning ECS LAN

- The connection technology for the individual LAN segments is freely selectable and can be mixed as desired.
- Transmission speed is dictated by the maximum cable length in accordance with RS 485. The ECS LAN normally runs at 62.5 kBaud, and the maximum cable length is thus 1.2 km (see also section 7.6 on page 43).
- The transmission cable must be terminated at both ends (but nowhere else) with terminating resistors. The terminating resistors are integrated and can be activated and deac-tivated via the control panel. Correct functioning of the 2-wire connection can only be assured with integrated terminating resistors. No external resistors may be connected!
- Loop resistance of the transmission cable with 2-wire technology may not exceed 100 Ω.
- Up to 16 summators can be connected to a bus segment. If the terminating resistors are correctly connected (see above), branch lines have been minimized and the loop resistance of the transmission cable is less than 100 Ω, up to 32 summators can be operated at a single segment.
- User statistics can be retrieved via the control panel (device status).

Bus Left, Bus Right
Each summator provides 2 complete ECS LAN ports. They're designated LAN L and LAN R. Each of these ports can be operated with either 2-wire or 4-wire transmission technology (RS 485).
2-Wire
A bus system within which several summators are connected to a common bus line must be set up with 2-wire technology.
4-Wire
4-wire technology is used where especially long transmission paths have to be spanned or where boosters are required, in which case only line-to-line connection is possible.
Connection Lengths (LAN bus)
If several summators (up to 16) are arranged in relatively close proximity to each other (total bus length of max. 100 m), bus connection with a twisted pair cable is recommended. Line-to-line connection with a twisted four-wire cable should not be set up until the distance between 2 summators is greater than 400 m (max. 1200 m).



Assignment of **ECS LAN** Connections

User Directory
Directory of ECS LAN Users
Each summator automatically prepares an internal directory (ECL command: DIR) of all interconnected ECS LAN users (insofar as unequivocal IDs have been assigned throughout the entire system). Each summator indicates its presence system-wide every 3 seconds with a so-called broadcast message, so that all summators which receive this message can correspondingly update their internal directories. If the message is not transmitted for a period of more than 20 seconds, the respective summator is removed from the internal directories.

Unequivocal Identification
An unequivocal summator ID must be assigned to each summator within the ECS LAN system. 255 different, freely selectable IDs are possible.
An ID has the following format: A, A1 .. A9, B, B1 … B9, .. , Z, Z1 .. Z4
System-Wide Access to Measurement Data
Example: You would like to retrieve total energy for channel 1 at summator D1 from summator**A**: **<A> D1:Etot 1**

4.9 LAN LED (LANL/LANR)
Two LEDs, one for bus left and the other for bus right, indicate error-free operation of the ECS LAN:

- If no ECS LAN users are connected, the LEDs don’t light up.
- If one or more users are connected to the respective bus segment, the LED lights up.
- If two or more users have the same ID, the corresponding LAN LEDs blink at the users with the same ID. Exception: If the summators with the same ID are connected to the same LAN segment, no unequivocal error message is generated. For this reason, always compare the number of summators with the total shown in the user statistics when installing devices (control panel: device status).
- If the internal terminating resistor is not activated during bus operation, the affected LAN LED blinks.

4.10 LON Connection

LON is an intelligent bus concept which makes it possible for controllers, sensors and actuators to “talk” to each other. Quick and inexpensive wiring is achieved by means of intelligent decentralization. All of the nodes (users) are equipped with a neuron chip and communicate with each other via the LON Talk protocol. Data is transmitted via a standardized, floating, twisted pair cable which can be wired in bus, ring or star topology as desired (free topology!). The electrically isolating FTT10 transceiver used to this end is reverse polarity protected and transmits data at 78 kbps. Up to 63 nodes can thus be additionally connected to a U1604 summator via the integrated LON network. Energy values from the LON meters can be freely assigned to channels K1 to K64 via differential coupling.

4.11 LON LED

LON LED off
All LON channels deactivated (Haupt Text, page 36)
Blinking LON LED Error in communication with LON users
LON LED on LON bus OK

Measurement Data

5.1 Overview of Available Measurement Data

The following measurement data are available for each meter input and each virtual channel:
Energy (cumulative as of a specified starting point)

ETot	Total energy regardless of tariff
ETotT1	Total energy for tariff T1
ETotT2	Total energy for tariff T2
ETotT1+T2	Total energy for tariffs T1 and T2

Energy (cumulative for specified time periods)

EMax	EMax-1	…	EMax-xx
EMaxDay	EMaxDay-1	…	EMaxDay-10
EMaxMon	EMaxMon-1	…	EMaxMon-12
EMaxYear	EMaxYear-1	…	EMaxYear-4

Cumulative energy for the current and the last xx * intervals (measurement data list)
Cumulative energy for the current and the last 10 days
Cumulative energy for the current and the last 12 months
Cumulative energy for the current and the last 4 years
* Interval value depending upon memory depth
Maximum Values from the Synchronizing Interval Measurement Data (with date and time)

EInt	EInt-1	…	EInt-xx
EDay	EDay-1	…	EDay-10
EMon	EMon-1	…	EMon-12
EYear	EYear-1	…	EYear-4

The xx * highest values
Maximum energy for the current and the last 10 days
Maximum energy for the current and the last 12 months
Maximum energy for the current and the last 4 years
Costs (cumulative as of a specified starting point)

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

Power (mean values for specified time periods)

Pmom			
PInt	PInt-1	…	PInt-xx

Instantaneous power between the last 2 meter pulses
Power for the current and the last xx * intervals (measurement data list)

PDay	PDay-1	…	PDay-10
PMon	PMon-1	…	PMon-12
PYear	PYear-1	…	PYear-4

Mean power value for the current and the last 10 days
Mean power value for the current and the last 12 months
Mean power value for the current and the last 4 years
Maximum values from the synchronizing-interval measurement data (with date and time)

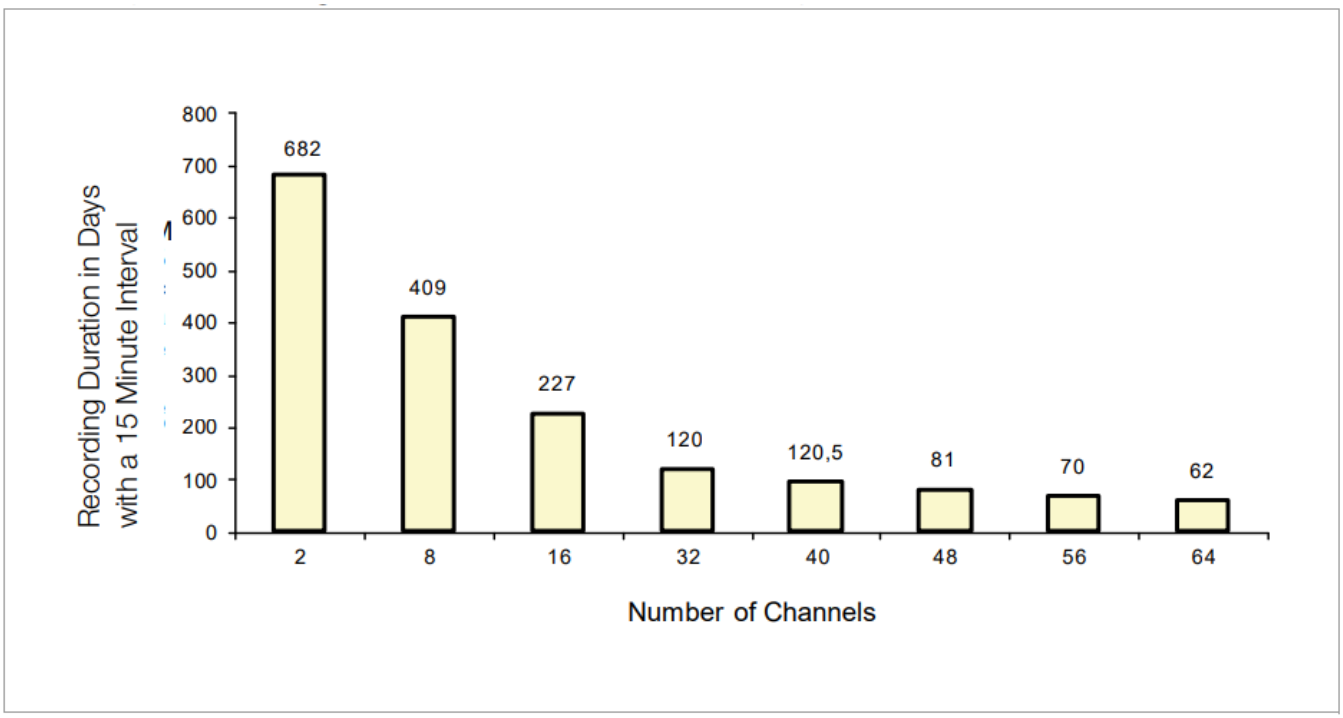
PMax	PMax-1	…	PMax-10
PMaxDay	PMaxDay-1		PMaxDay-10
PMaxMon	PMaxMon-1	…	PMaxMon-12
PMaxYear	PMaxYear-1	…	PMYear-4

The 10 highest values for all measuring intervals Maximum power value for the current and the last 10 days
Maximum power value for the current and the last 12 months
Maximum power value for the current and the last 4 years

Summary of Available Measurement Data per Channel

Energy Values	**Features**	**Maximum Energy Values**	**Maximum Power Values**	**Costs**
Etot	Pmom			
EtotT1				CostT1
EtotT2				CostT2
EtotT1T2				CostT1T2
Eint	Pint	Emax	Pmax	
EDay	PDay	EmaxDay	PmaxDay	
EMon	PMon	EmaxMon	Paxon	
EYear	PYear	Emax Year	Pmax Year	

Relationship Between Recording Duration and Number of Channels
of the Synchronizing-Interval Measurement Data (measurement data list, format 0 → 3):



5.2 Synchronizing Interval Measurement Data List

The energy values measured during a specific interval can be saved to a measurement data list. This interval (duration: 10 s … 999 hrs., default: 15 minutes) is either derived from system time or the interval limit is determined by the edge of the meter pulse (default: channel 11). Energy measured during the interval (EINT) is entered to the list along with date and time. The mean power value for the interval (PINT) is calculated from EINT and the duration of the corresponding interval.

Formatting the Measurement Data List

Attention!

The contents of the measurement data list are deleted during formatting.

The number of entries in the measurement data list depends on the number of channels. The measurement data list can thus be formatted according to the desired number of channels. Formatting is only possible via an interpreter. The resolution of the data range is determined at the same time (ECL command: FORMAT).

Specifying the Number of Entries

The format command reserves space within system memory for the selected channels. In this way, the possible number of entries (records) is specified, but not the recording duration which depends entirely on interval time. Example: Only channels 1 through 4, channel 17 and channels 21 through 23 will be recorded to the measurement data list.

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

If the format command is invoked without parameters, status information is read out to the measurement data list. In particular how many entries can be recorded in the measurement data list is shown here.

<A> FORMAT = 1…4 + 17 + 21 …23

<A> format

Format (0): 8 channels, 26,214 entries (= 273 days with an interval of 15 minutes)

Channels: 1;2;3;4;17;21;22;23

Reading Out the Measurement Data List

The data saved to the measurement data list can be read out together with date and time via the serial port by means of ECL command EINT. The following example shows the read-out of all measurement data from channels 1 through 5 in ASCII database 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

Retrieving a Specific Entry

The ECL command INDEX makes it possible to read out data as of a specific date. The following example (in plain text read-out) shows the value from the measurement data list for channel 1 on 16 April 1993 at 6:15 p.m.:
<A> Index 16.04.93 18h15, Eint/ 1 .
16.04.93 18:15:00 : Eint-863 (01:Motor7) = 0.99 kWh

Memory Structure of the Measurement Data List

The measurement data list is a ring buffer of fixed size which is correspondingly formatted. It's accessed by means of an index number. Index 0 always makes reference to the most up-to-date, current interval. Index 1 makes reference to the last interval and index 2 to the next to last etc. The ECL command INDEX converts a timestamp into the corresponding index number.

Ring Buffer

When memory capacity has been exhausted, the oldest entry (with the highest index number) is deleted in favor of the new entry. Index 1 is thus assigned to the interval which has just been concluded, and the index numbers of all previous entries are increased by 1.

Measurement Data List Value Range

Limitation of Resolution due to Data Reduction

All of the summator's data registers have an internal width of 8 bytes (64-bit floating point). However, this has to be converted to a data format with a width of 2 bytes for the data list (as of Eint-1), for which overall recording duration is directly dependent on available memory capacity (which is associated with reduced accuracy). The fact that only energy values are saved (and not power values because these are calculated) results in the following limitation of the numeric range with standard "0" formatting:

Data range encoding: (0: standard. Resolution specified in [ ])
0 : 0…+/-0.8191[0.0001]…+/-81.91[0.01]…+/-8191[1]…+/-819100[100] 1 : 0…+/-8,191[0.001]…+/-81.91[0.01]… +/-819.1[0.1]…+/-8191[1] 2 : 0…+/-16383[1]……+/-163830[10] 3 : 0……+32767[1]……+327670[10] 4 : 0..+/-99999999 [8 decimal places, smallest place: 1E-6] If the number is > 99999999, the leading places are omitted.
1234567890 –> 34567890 Omission of the first 2 places
12345678.9 –> 12345679 8. Place is 5/4 rounded
1234567.8 –> 1234567.8 No limitation
12.345678 –> 12.345678 No limitation
12.3456789 –> 12.345679 8. Place is 5/4 rounded
1.23456789 –> 1.234568 Only 6 places after the decimal (see below)

Notes

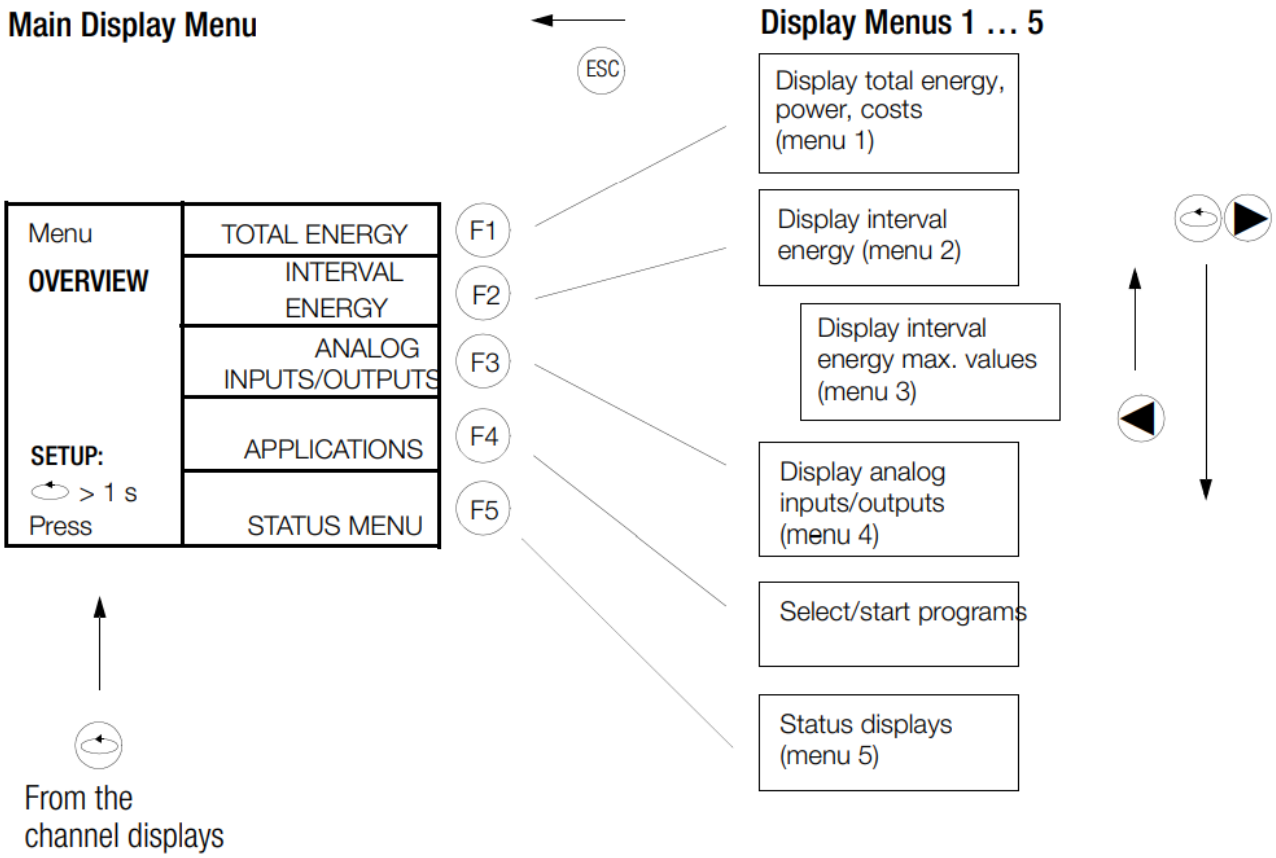
– Encoding types 0, 1, 2 and 3 use two bytes per entry, but encoding type 4 uses four bytes per entry and memory duration is thus cut in half.
– Encoding type 4 is only available as of V2.46, and interval data with type 4 encoding cannot be read out from summators with older firmware versions!
– With encoding type 4 the smallest resolution is 1E-7, and with faster read-out using ext.'#' resolution is 1E-6 (the 6 th place after the decimal is 5/4 rounded if required).

Operation (display menus)

The U1604 summator is not equipped with any display or control elements. ECSwin software is used for communication and parameters configuration. The display in the panel mode corresponds to menu prompting for a U1601 summator.

Extreme care is required when changing the parameters of serial ports COM1 and COM2.
In the case of different settings no communication is possible between the PC and the summator.
Only one interface should be changed at any given time so that the summator can still be controlled with the other. COM2 is set to ECL or ECL+HP to this end.

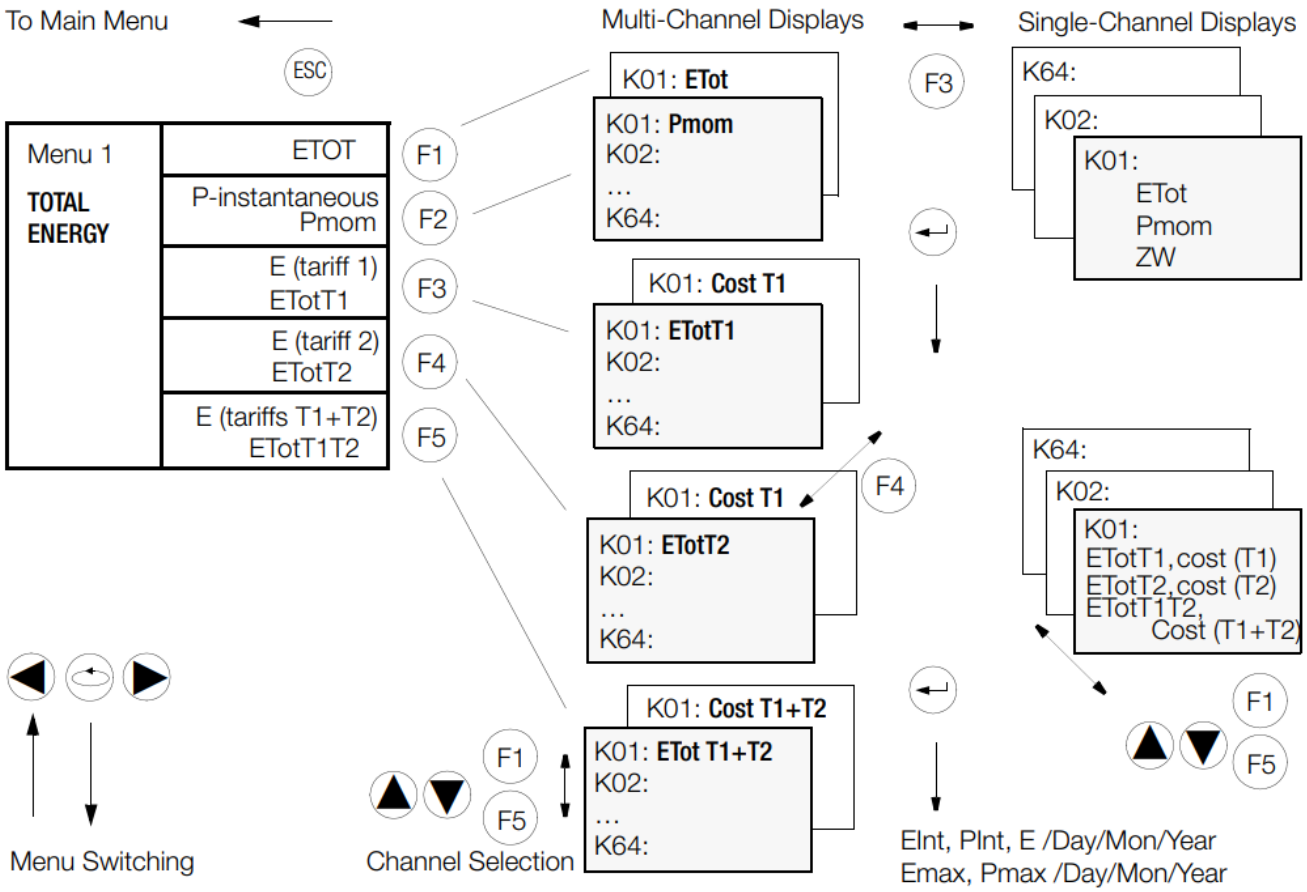
6.1 Menu: Overview (main display menu)



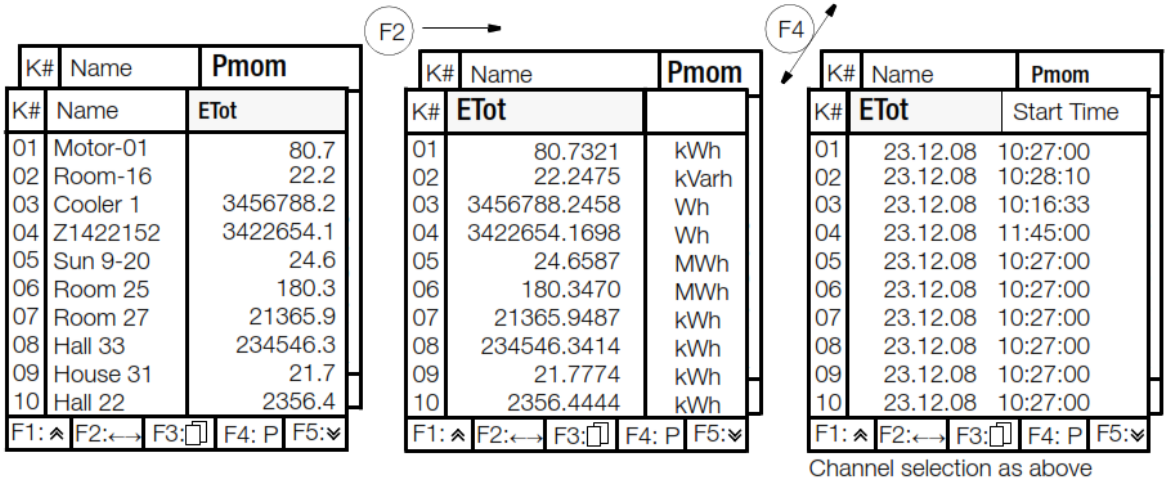
The following applies in general in the display submenus:

Switching 1 channel further: ▲▼ 10 channels further: F1 F5

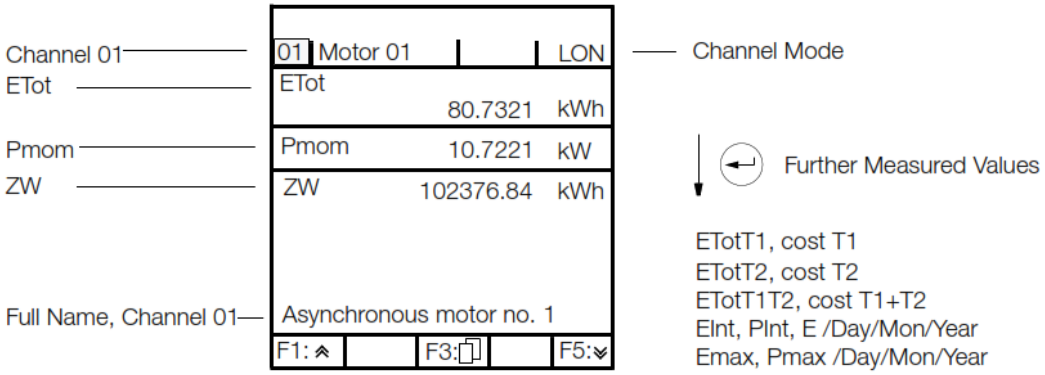
6.2 Menu 1: Display Total Energy, Power, Costs



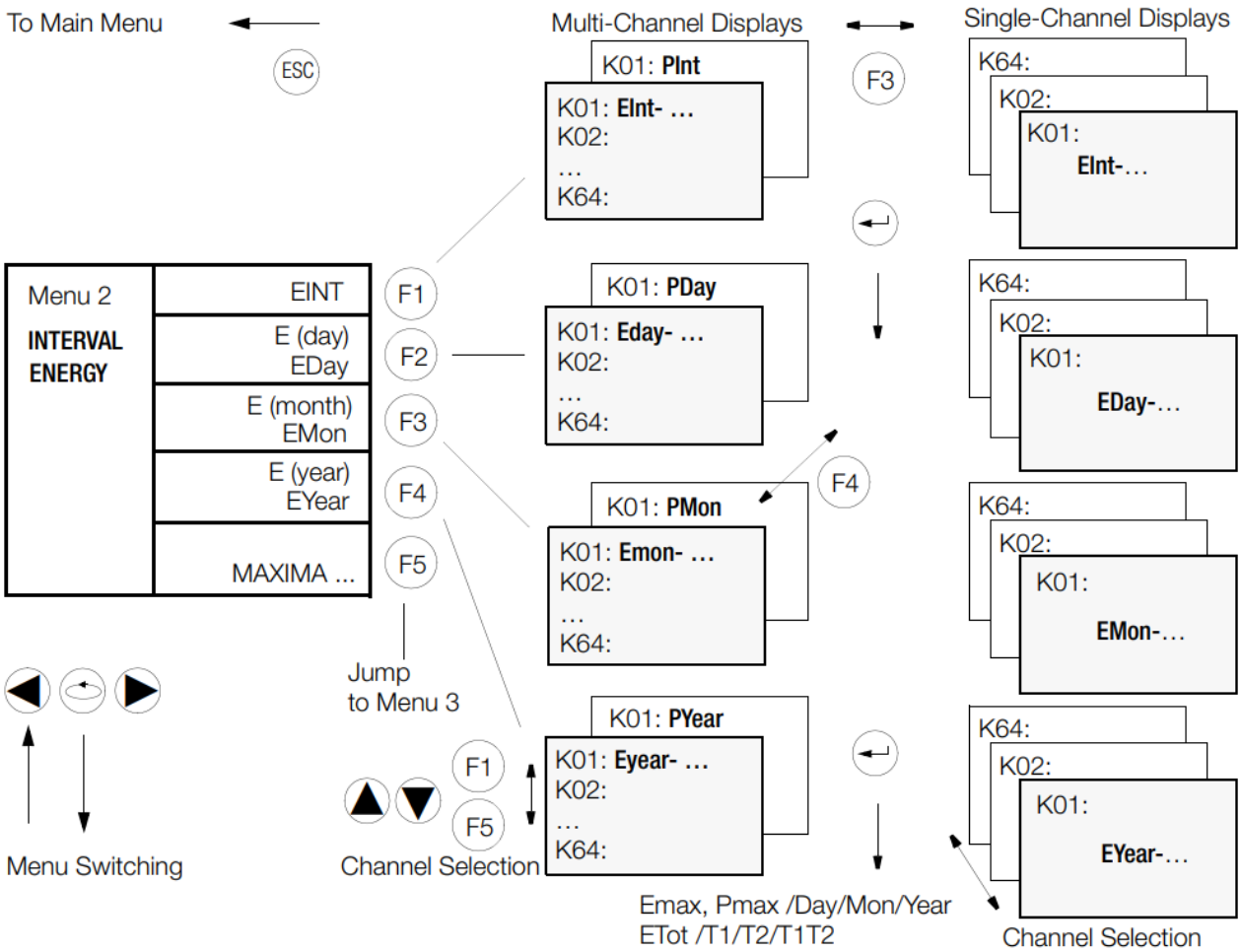
• Multi-Channel Displays (all channels with only 1 measured value)



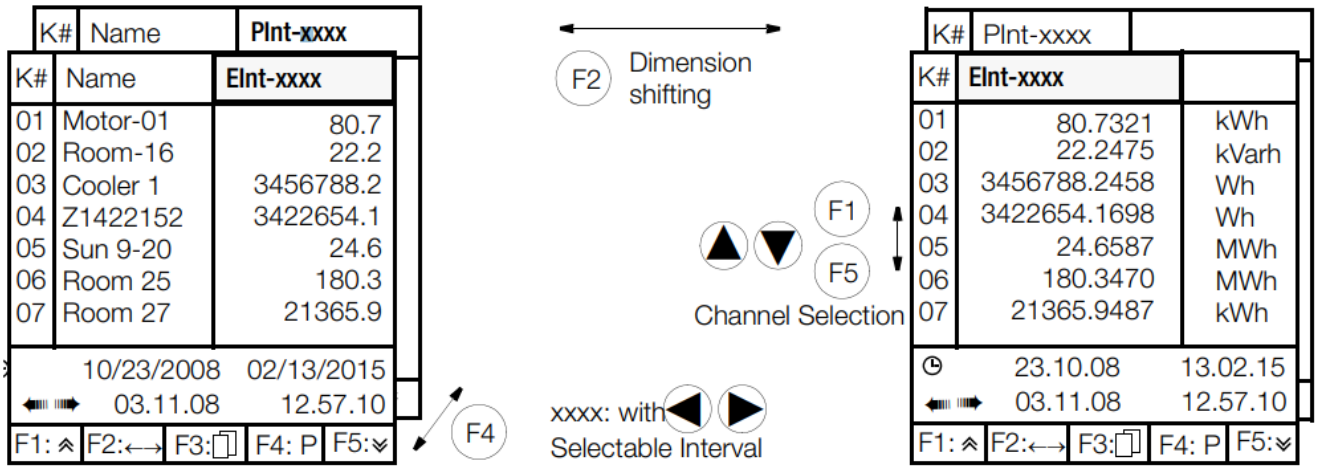
• Single-Channel Displays (1 channel with all measured values)



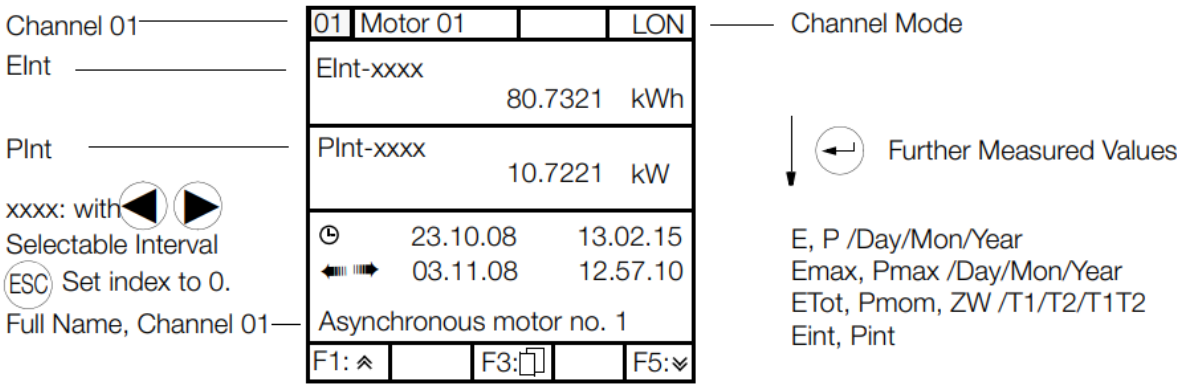
6.3 Menu 2: Display Interval Energy



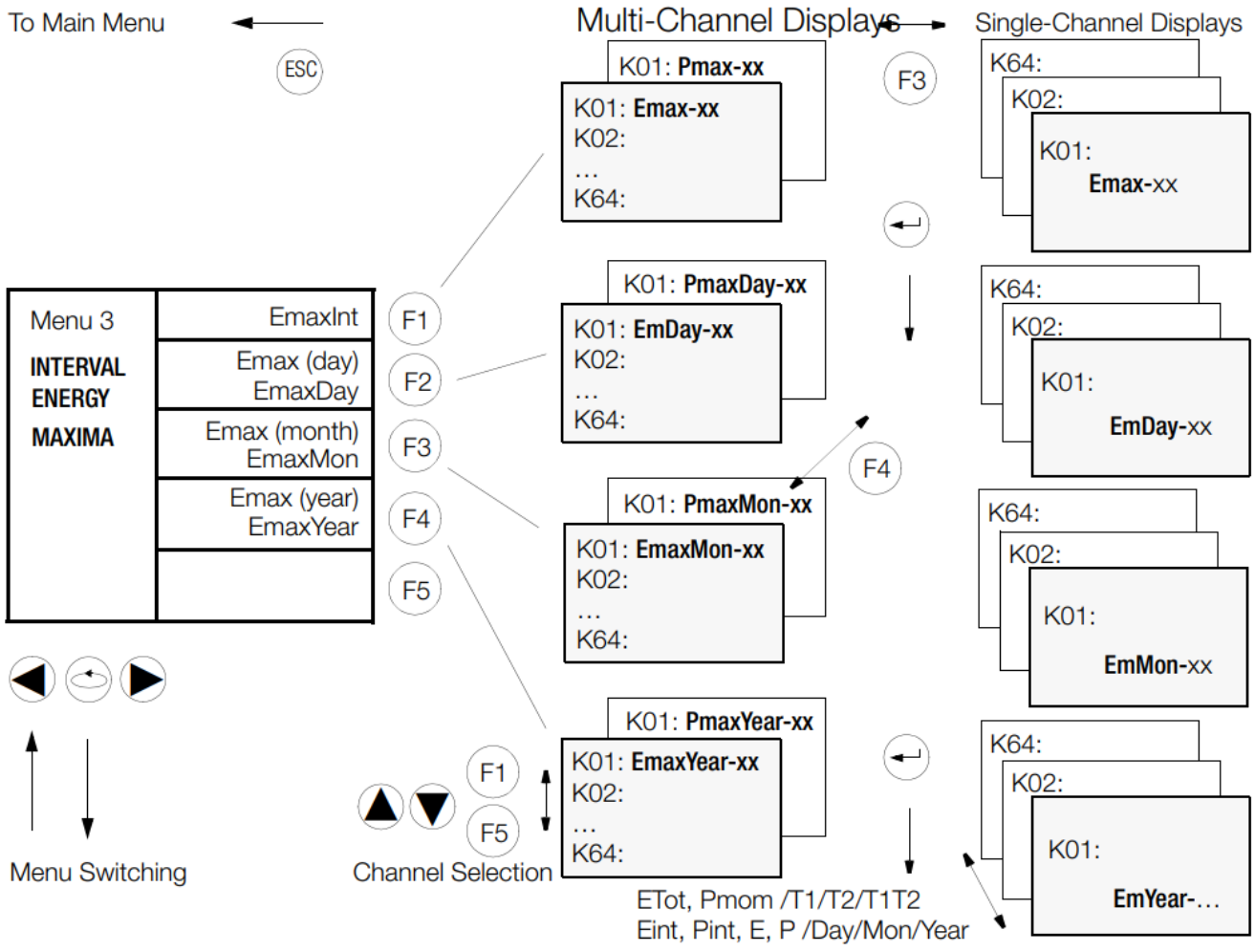
- Multi-Channel Displays



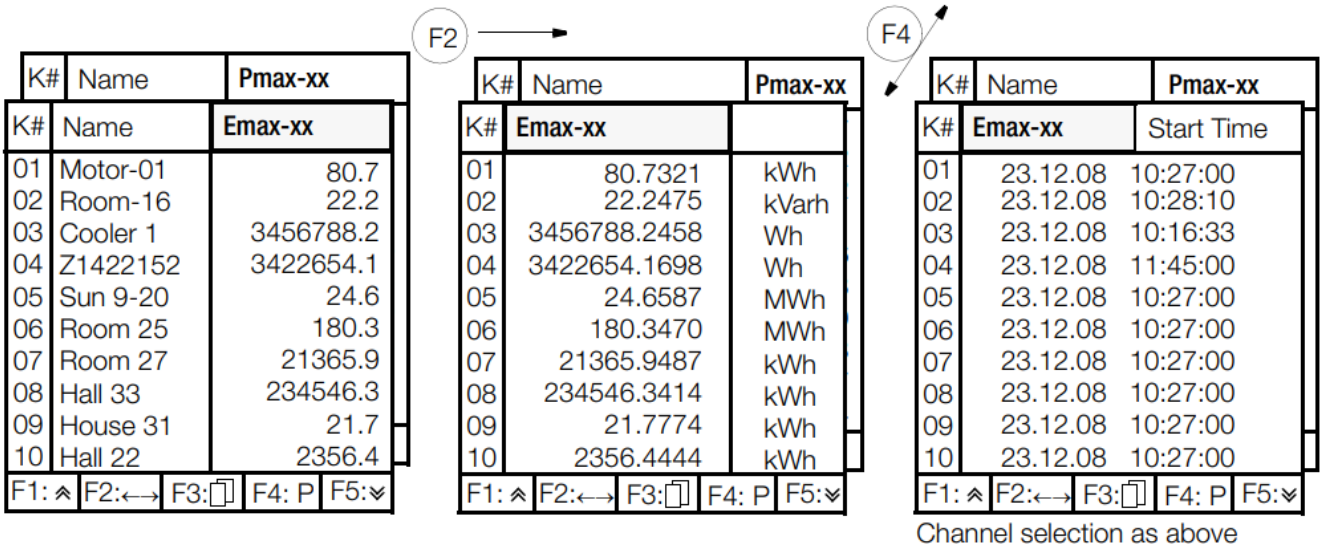
- Single-Channel Displays



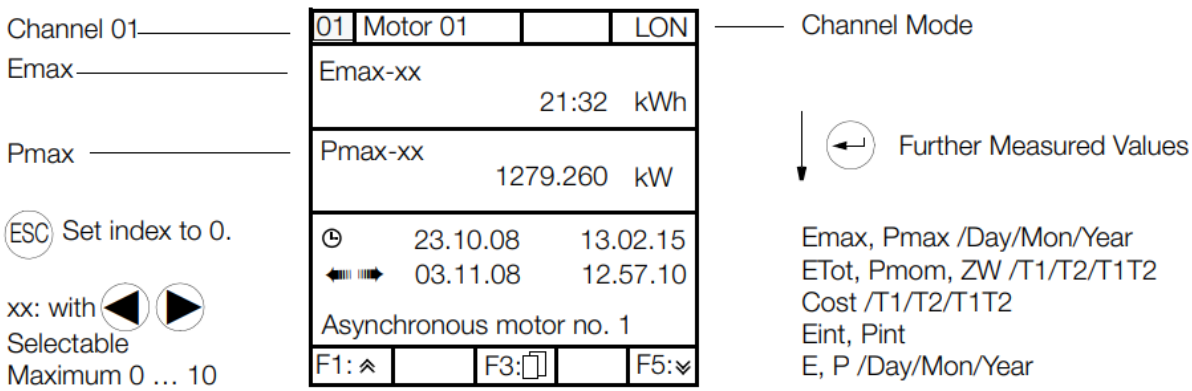
6.4 Menu 3: Display Maximum Interval Energy Values



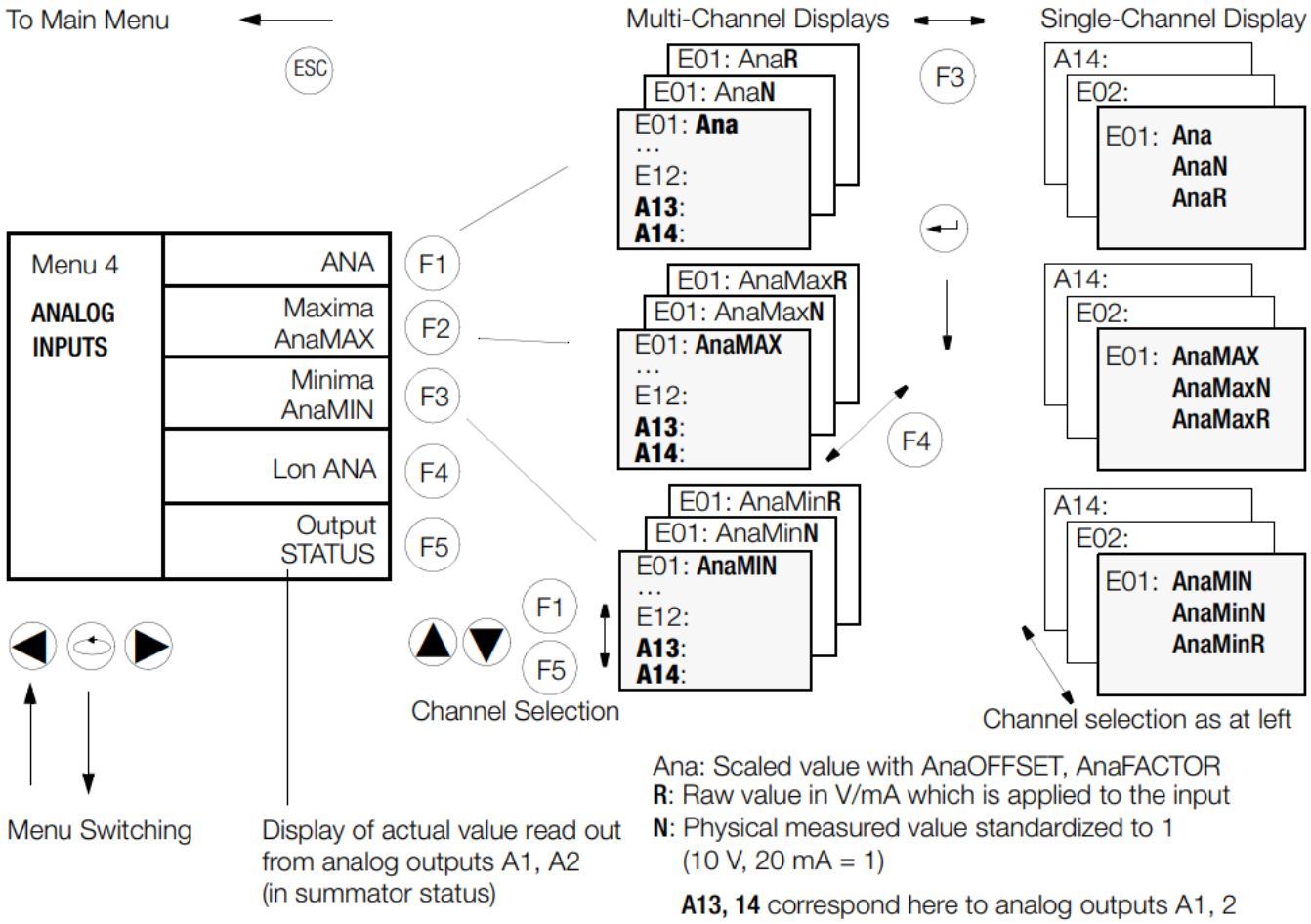
• Multi-Channel Displays



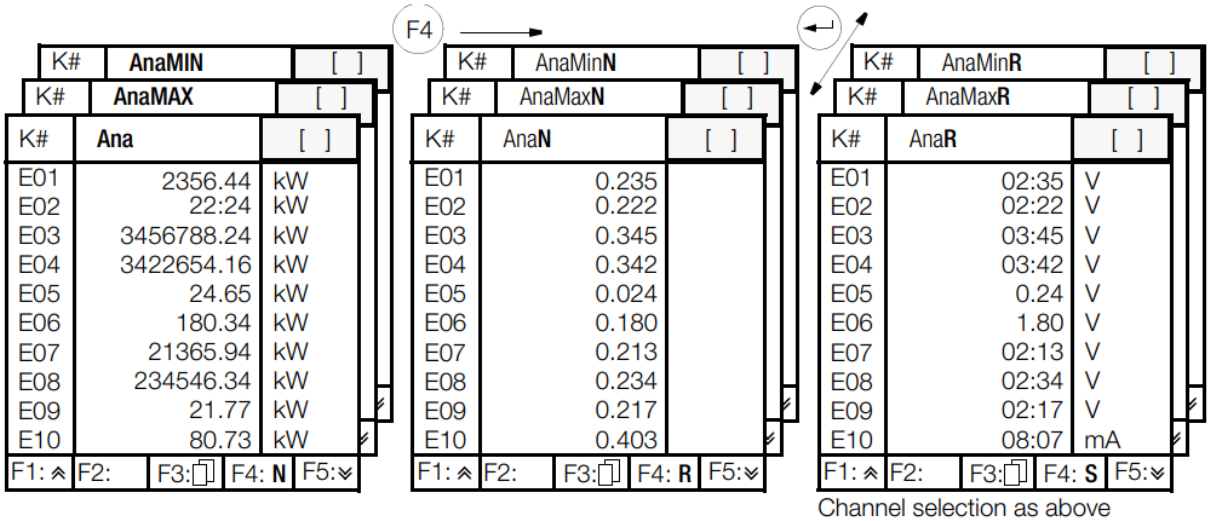
• Single-Channel Displays



6.5 Menu 4: Display Analog Inputs/Outputs

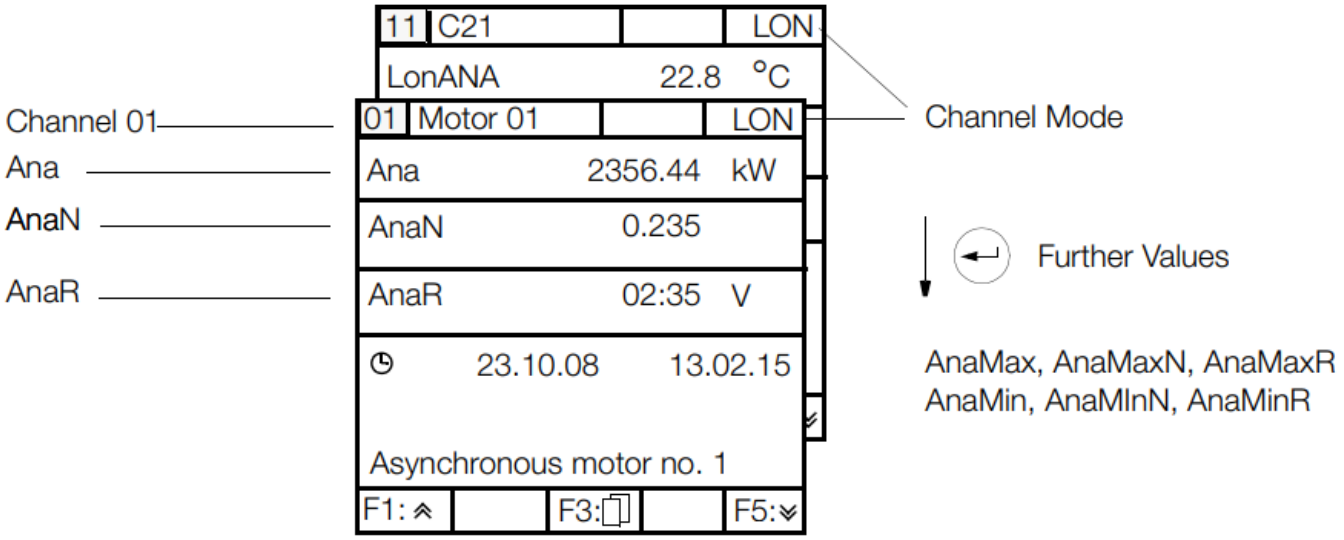


• Multi-Channel Displays



K#	Name	LonANA
11	C21	22.8
12	Advance 1	73.4

F1: F2: F3: F5:

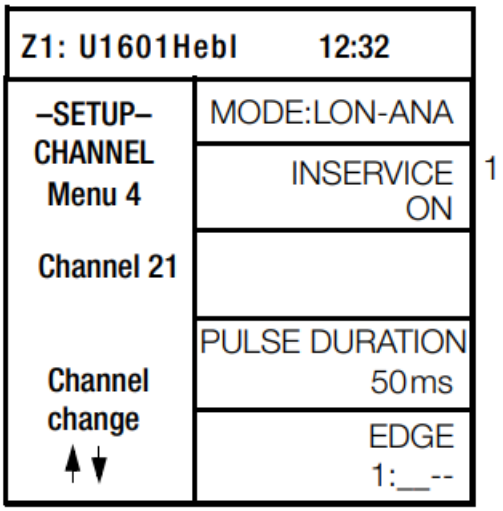


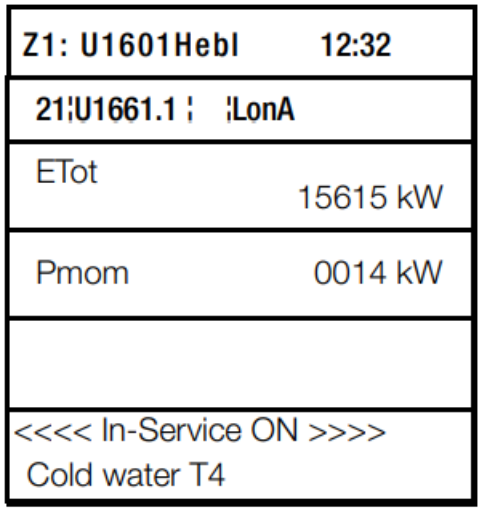
6.6 In-Service Function

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's currently being calibrated (Err Chan 24: in-service).
The in-service function is activated by configuring the INSERVICE feature:
Example: INSERVICE FEATURE = 3
This function is only effective per channel in mode 4 (= LON).

INSERVICE	**Explanation**
0	In-service not available (default setting)
1	In-service available
3	Same as 1, but direct jumping is also possible from the individual basic display to SETUP C HANNEL menu 4 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

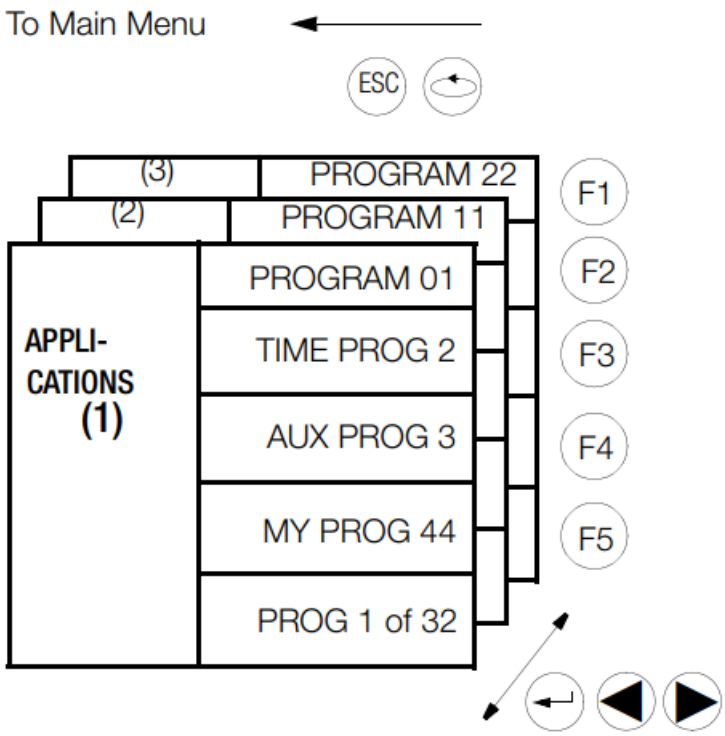
In-service can be configured with CHANNEL DATA under SETUP in menu 4: In-service OFF / In-service ON / ALL OFF
In-service activation is indicated in the individual basic display.





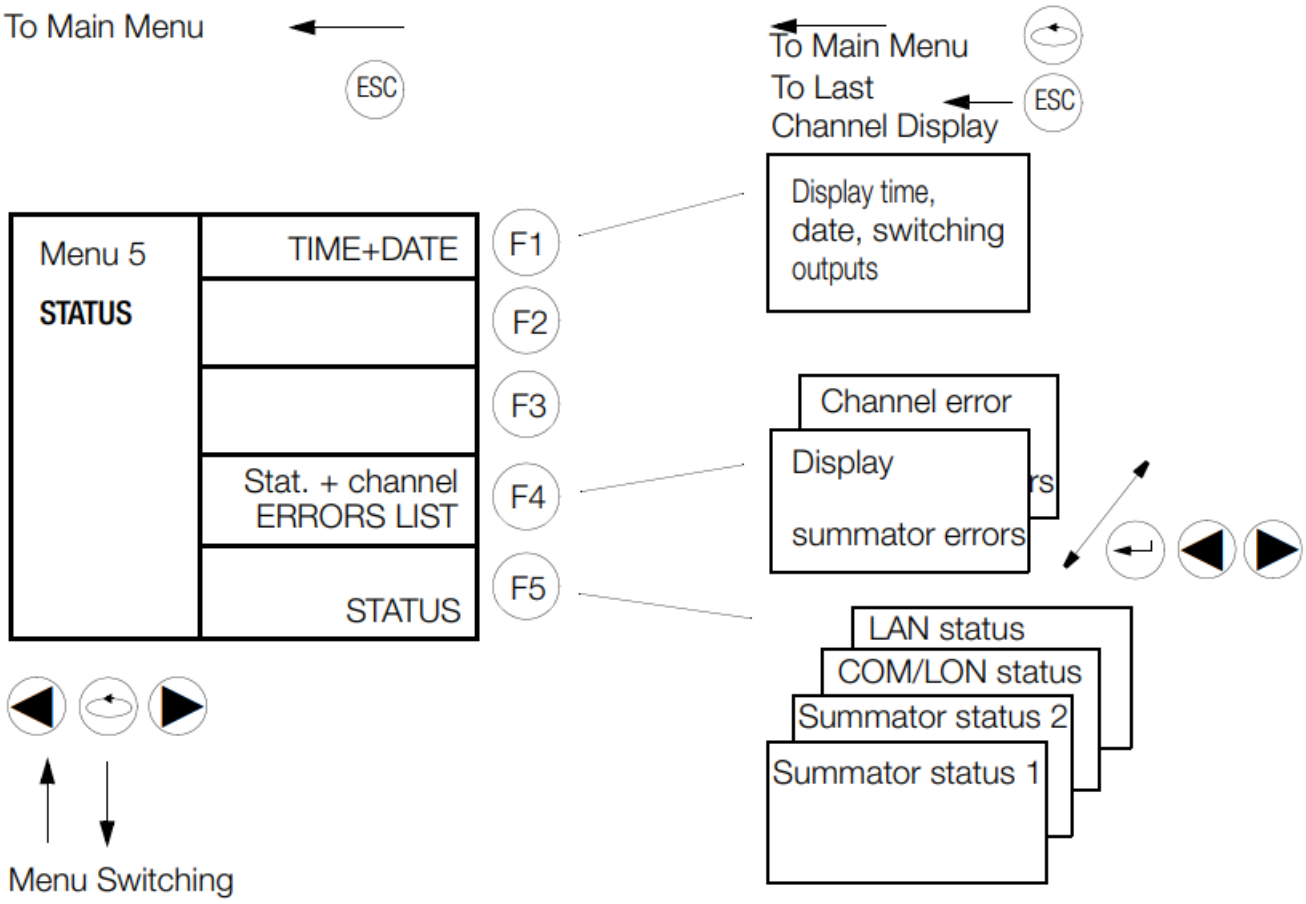
The *ERIS enumeration is used specifically with the in-service function.
Example: All: Chanel *eris reads out all channels with the in-service status.
1 Is only displayed when the in-service function is switched on.

6.7 Menu: Display Applications

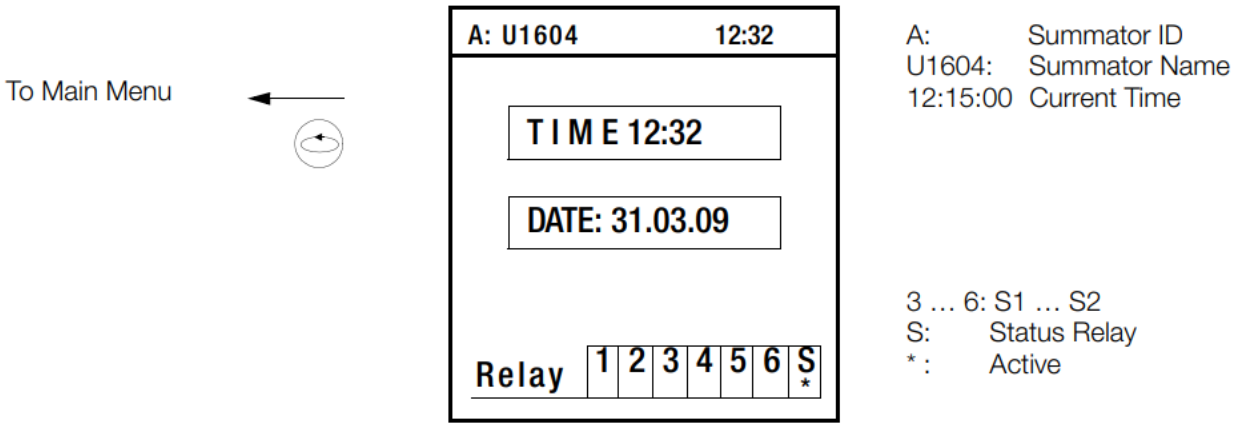


15 programs can be specified here which you have created by means of ECL Inter- preter and stored to the summator via the interface.
These involve 15 of 32 possible P programs which execute an action one-time only after pressing a key, but don't run any cyclical tasks, for example:
– Execute calculations (weighting of energy values)
– Read-out of certain energy channels via the interfaces

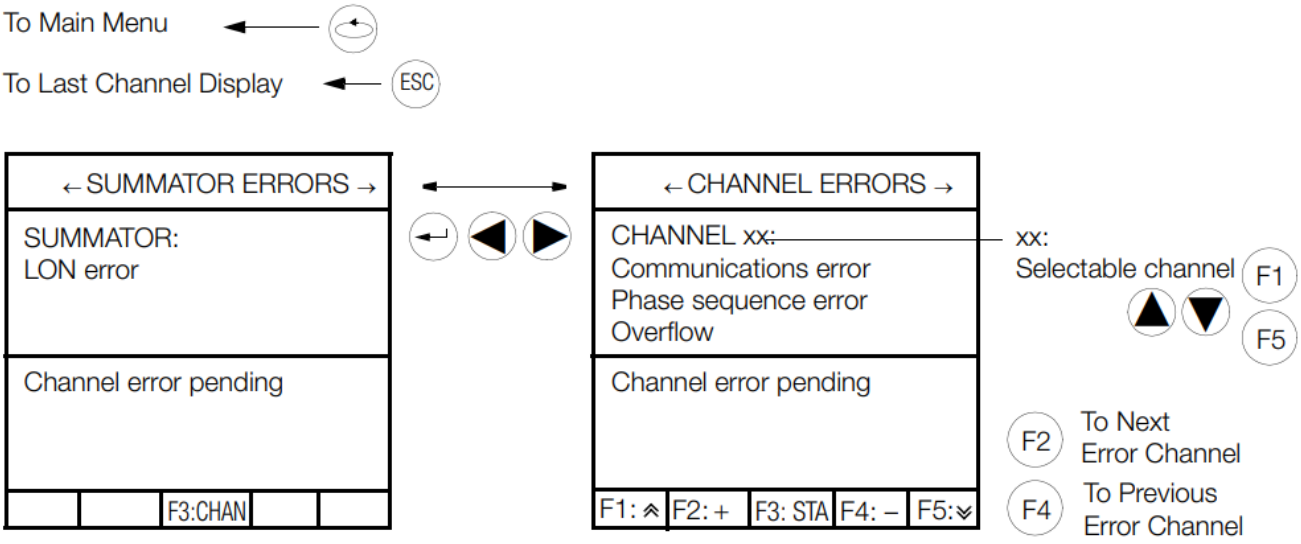
6.8 Menu 5: Display Status Menu (time, relay, errors, interfaces)



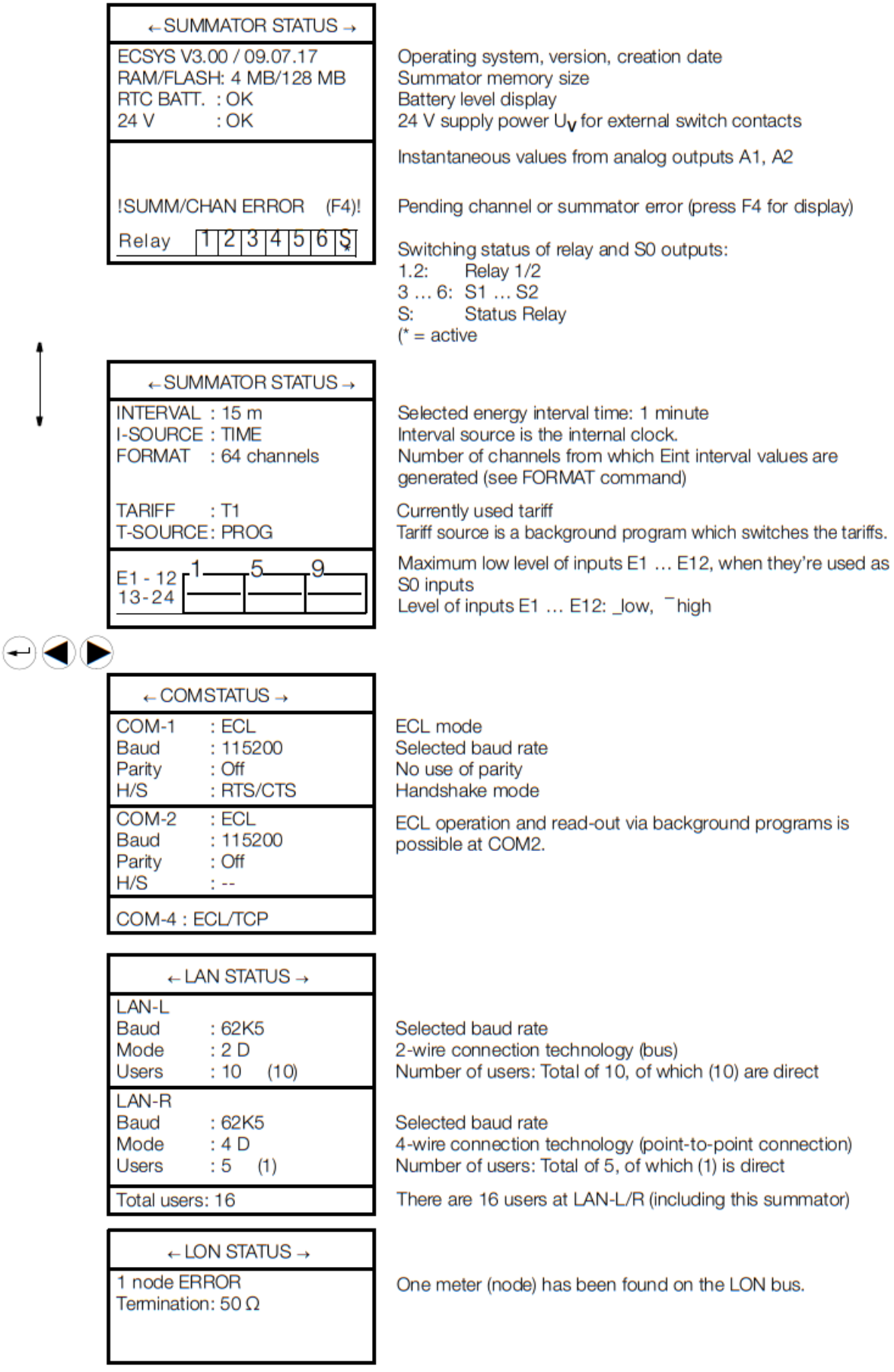
• Display Time, Date, Switching Outputs



- Display Summator/Channel Errors (see errors table)

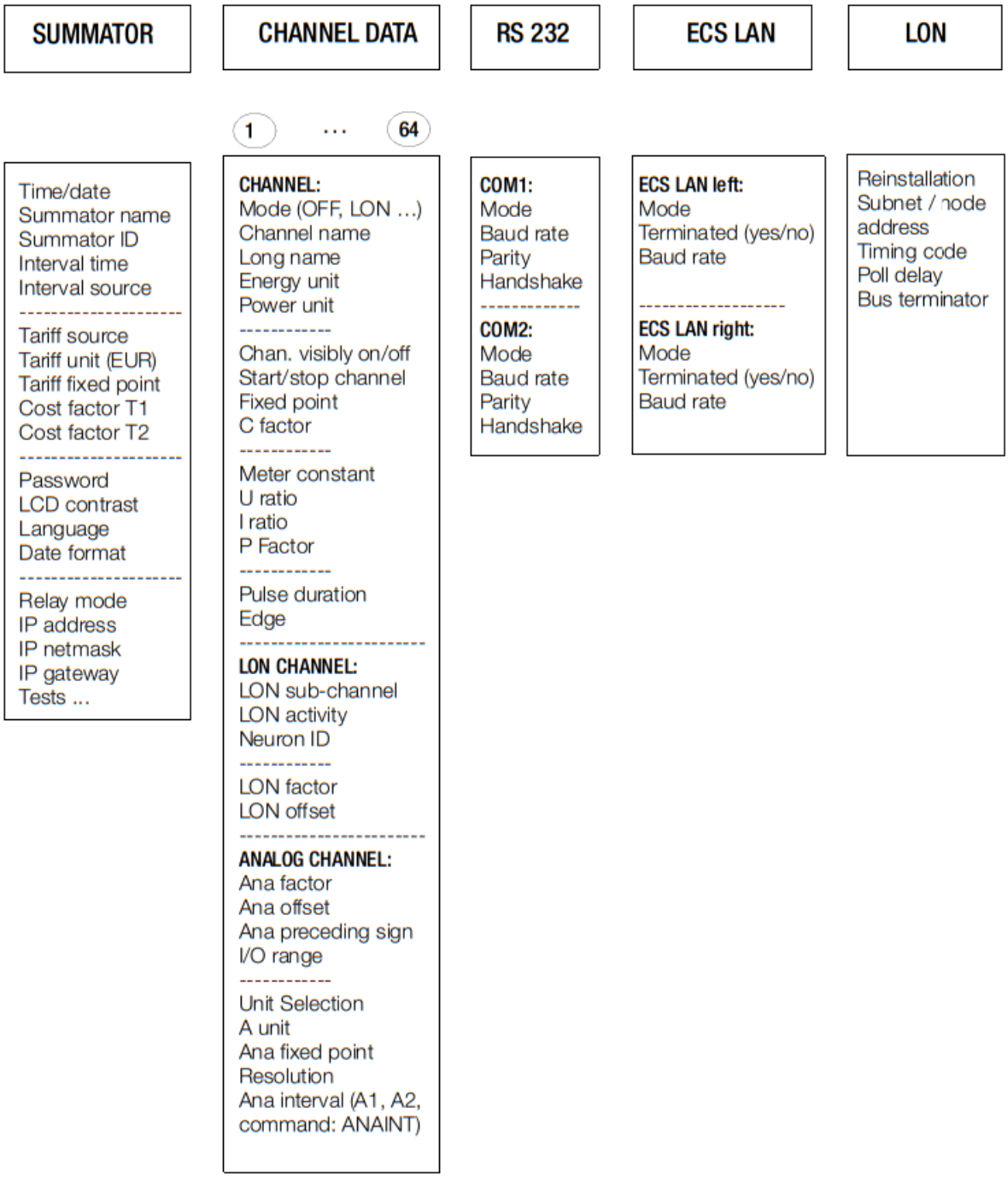


Status displays

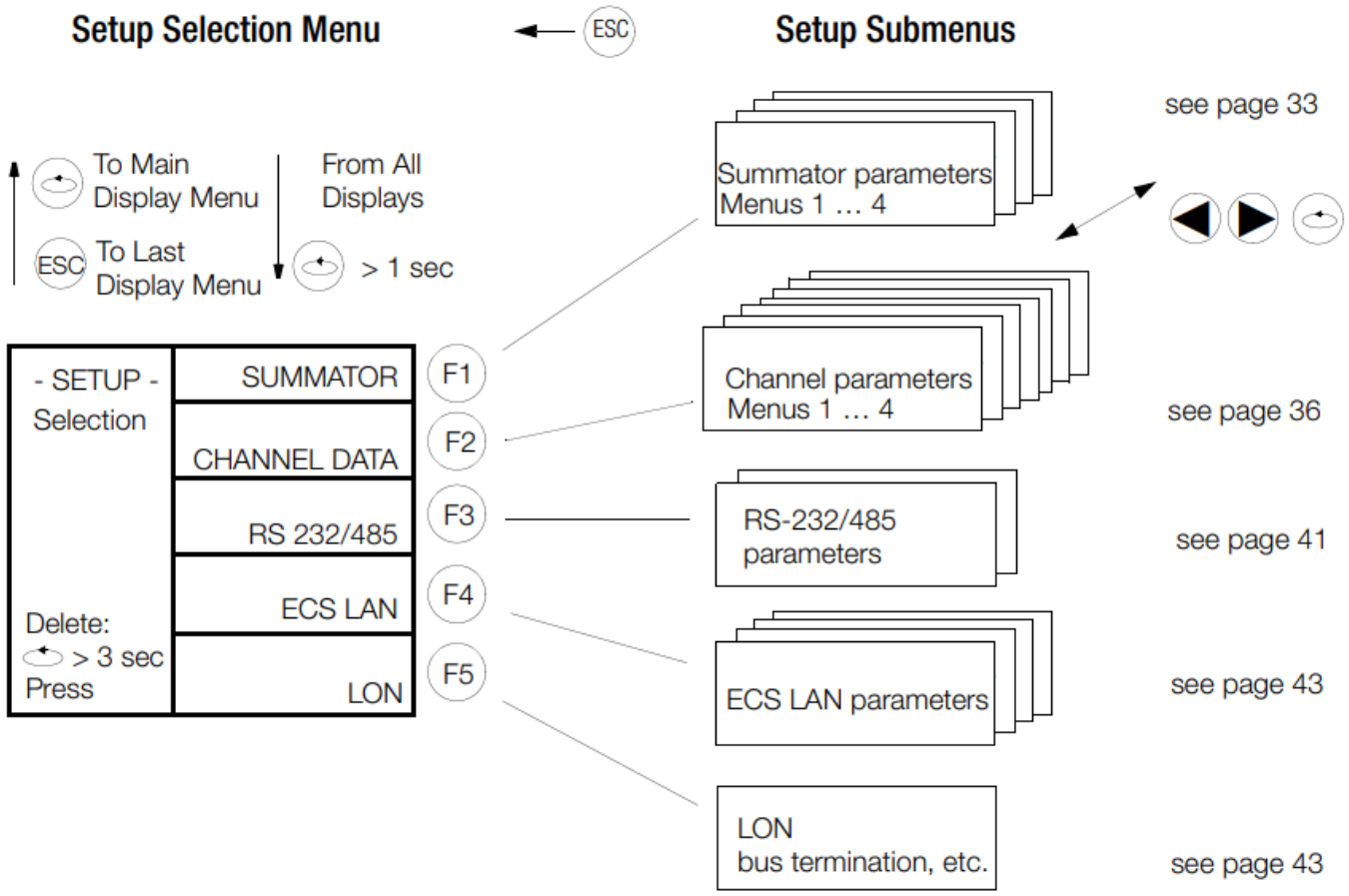


Basic Configuration

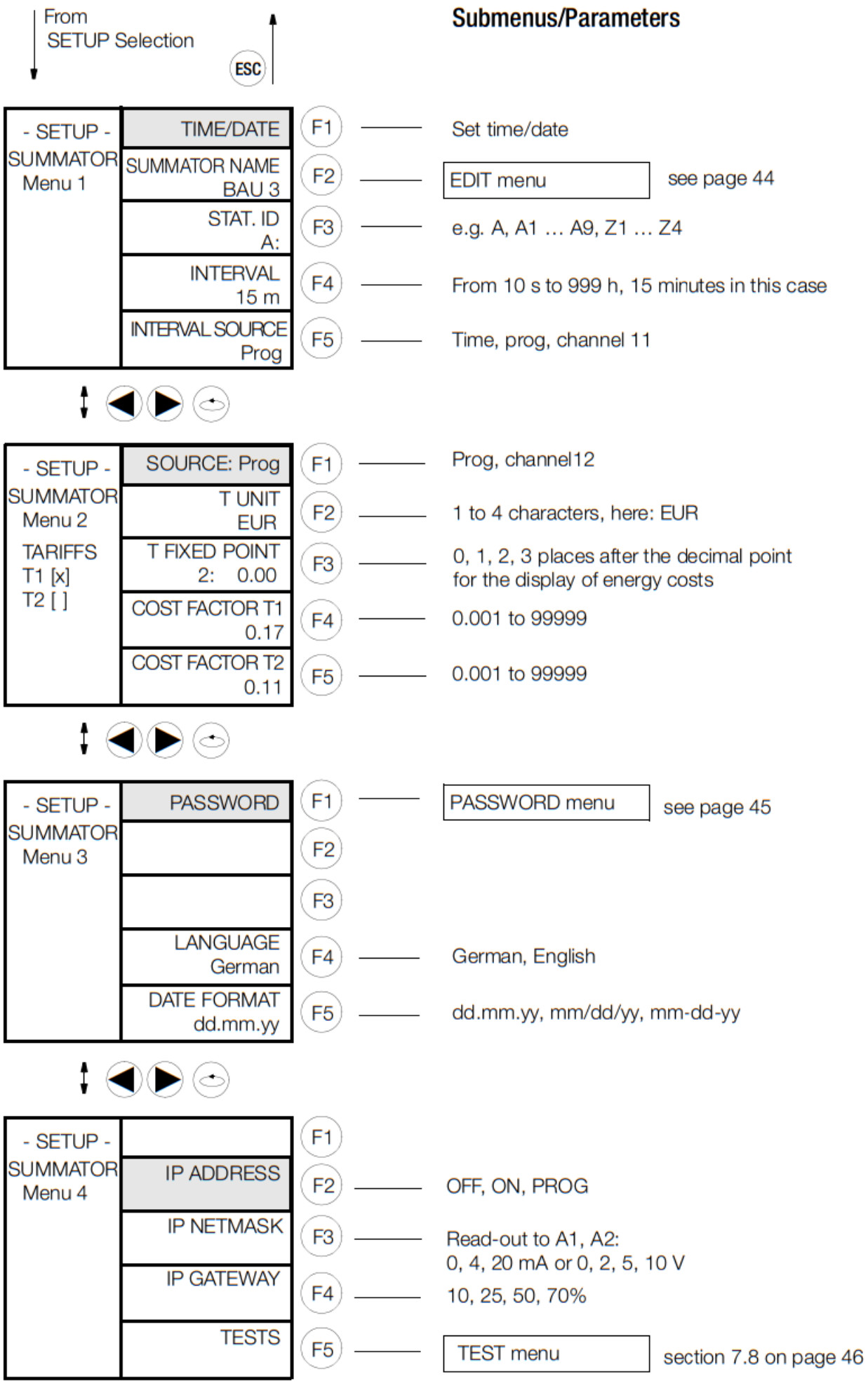
7.1 Overview of Setup Parameters



7.2 Setup Selection Menu



7.3 Summator Parameters (IDs, intervals, tariffs, outputs …)


From
SETUP Selection
ESC
Submenus/Parameters
- SETUP -
SUMMATOR
Menu 1
TIME/DATE
SUMMATOR NAME
BAU 3
STAT. ID
A:
INTERVAL
15 m
INTERVAL SOURCE
Prog
F1
F2
F3
F4
F5
Set time/date
EDIT menu
see page 44
e.g. A, A1 ... A9, Z1 ... Z4
From 10 s to 999 h, 15 minutes in this case
Time, prog, channel 11
- SETUP -
SUMMATOR
Menu 2
TARIFFS
T1 [x]
T2 [ ]
SOURCE: Prog
T UNIT
EUR
T FIXED POINT
2: 0.00
COST FACTOR T1
0.17
COST FACTOR T2
0.11
F1
F2
F3
F4
F5
Prog, channel12
1 to 4 characters, here: EUR
0, 1, 2, 3 places after the decimal point
for the display of energy costs
0.001 to 99999
0.001 to 99999
- SETUP -
SUMMATOR
Menu 3
PASSWORD
LANGUAGE
German
DATE FORMAT
dd.mm.yy
F1
F2
F3
F4
F5
PASSWORD menu
see page 45
German, English
dd.mm.yy, mm/dd/yy, mm-dd-yy
- SETUP -
SUMMATOR
Menu 4
IP ADDRESS
IP NETMASK
IP GATEWAY
TESTS
F1
F2
F3
F4
F5
OFF, ON, PROG
Read-out to A1, A2:
0, 4, 20 mA or 0, 2, 5, 10 V
10, 25, 50, 70%
TEST menu
section 7.8 on page 46

Date/Time

After entering the time to the first line, the cursor jumps to the date line. Entries are immediately active at the integrated real-time clock for which reason the entry cannot be aborted. ECL command: TIME/DATE

Summator Name

The summator name must have a length of 1 to 8 characters. If no name is entered, "-" is automatically assigned as the name. The following characters are possible: _+ – 0 … 9 A … Z a … z . ECL command: SUMMATOR

Summator ID

Unequivocal IDs must be assigned within an ECS LAN. The same ID may never be assigned twice. Up to 255 IDs are possible. The character string has a maximum length of 2 characters. If a blank space is entered as part of the character string, the character string is cut off as of the blank space after the entry has been acknowledged (F4). An ID has the following format: A, A1 … A9, B, B1 … B9 … Z, Z1 … Z4.

Interval Time

Entry range for the synchronizing interval: 10 seconds to 999 hours (entry in seconds).
ECL command: INTERVALL (ITV)

Interval Source

The synchronizing interval can be generated in three different ways:
Time: the intervals are generated in accordance with the selected interval duration.
Program: An interval is only generated with the ECL command SYNC=.
Channel 11: A meter input serves as a binary input for the synchronization signal. The selected pulse duration and edge are taken into consideration. ECL command: INTERVALSOURCE (IS)

Source (tariff source)

The valid tariff, T1 or T2, can be selected in two different ways: Channel 12: A meter input serves as a binary input for specifying the valid tariff. The selected pulse duration is taken into consideration. The edge parameter is used to specify which level is assigned to tariffs T1 and T2. If the "+" (1) edge is selected, logical zero (0 V at the input) corresponds to tariff T1, and logical one (24 V) to tariff T2. The opposite applies when the "-" (0) edge is selected.
Program: The valid tariff is specified with ECL command TARIFF=1 or TARIFF=2. These assignments only work if "Program" is selected as the source. ECL command: TARIFFSOURCE (TS)

Tariff Unit

The character string has a maximum length of 4 characters. The tariff unit must have a length of at least one character. ECL command: TUNIT

T Fixed Point

Specifies the number of places after the decimal which will be used for displaying accrued energy costs. ECL command: TFIX

Cost Factors T1 and T2

The procedure for entering the cost factors for tariffs T1 and T2 is the same.
The cost factor is used to convert energy to costs. This conversion can be used for the tariffs' total energy registers: ETotT1, ETotT2 and ETotT1T2. Entry ranges for cost factors: 0.000 to 99.999
ECL command: COSTFAC1 COSTFAC2

Password

A submenu appears here for the selection of passwords for 5 users (see page 45).

LCD Contrast

This menu is used to set contrast at the LCD. 20 steps are possible (-5 … +15). The default value is 0 which provides good results in most cases.

Language

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

Date Format

Three display formats are possible: dd.mm.yy, mm/dd/yy, mm-dd-yy.

S0 Mode

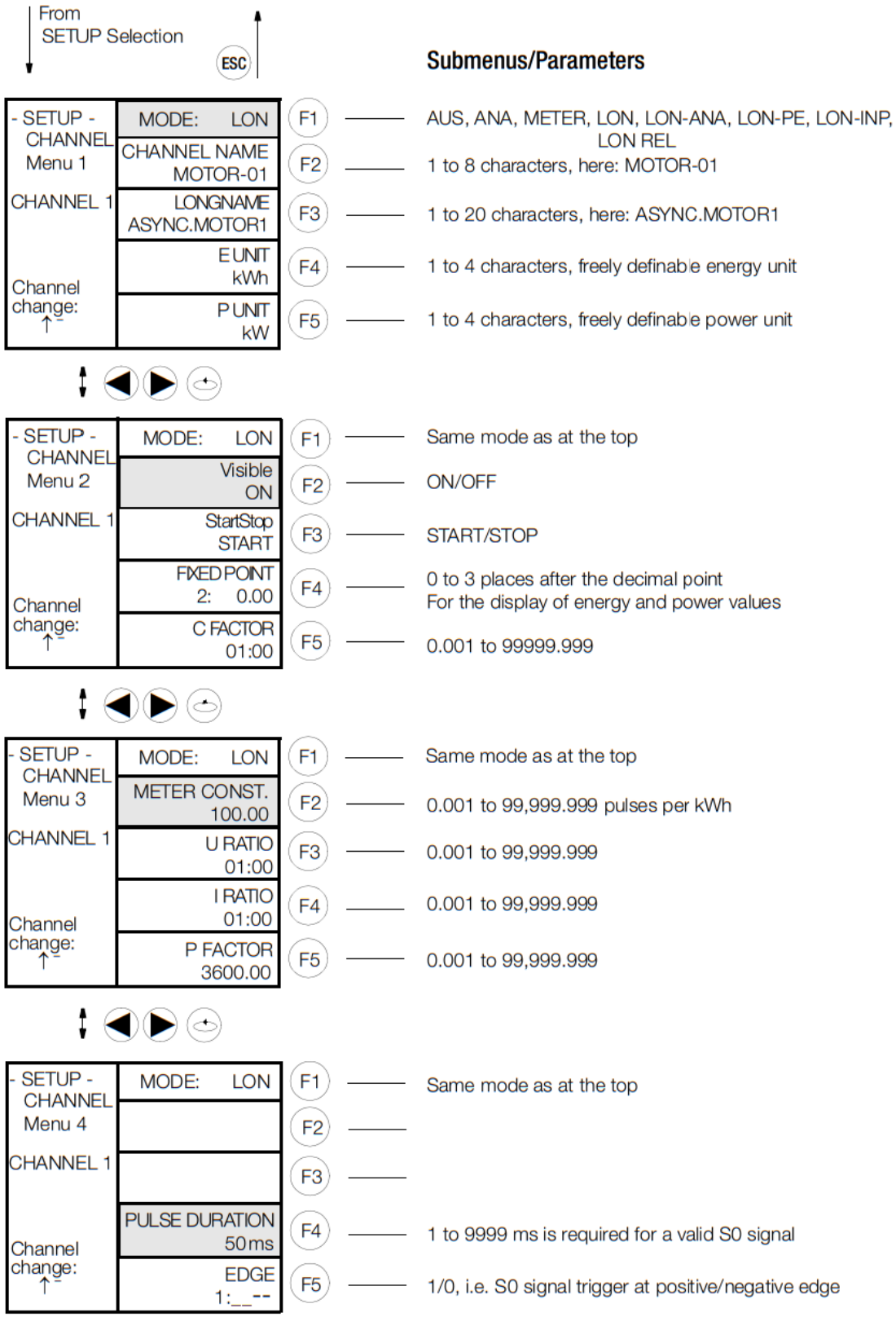
Selection of the operating mode of S0 outputs S1 … S2. In the PROG position, a user program (H/P program) determines the status of the outputs. ECL command: RELM.

S0/Level

The sensitivity of the S0 input channels (S1 … S2) can be specified in steps (10, 25, 50, 70%). ECL command: LEVEL

Bootstrap Loader and Tests

Invocation of the bootstrap loader: in the bootstrap loader menu (see page 46).
LED test: Display of several important LON parameters
LED test: Checks the 4 LEDs for correct functioning. All 4 LEDs light up during this test.
Channel Parameters (mode, name, units, displays …)



(Channel) Mode

Depending on the type of summator, the following selection can be made in the following submenu:

U1604: Channel modes 0 to 8

0: OFF: The channel is shut down entirely and all functions are off.

1: ANA: The U1604 is not equipped with an analog module.

2: P →E: PMOM=ANA → ENERGY (see section 6.2)

3: Meter: A binary input quantity in accordance with the S0 standard is used for energy measurement (COUN) (see section 6.2).

4: LON: Energy measurement data are fed to the system via interconnection of various LON users.

5: LON ANA Analog values via LON for A2000, A210/A230, DME400, U1661, U168X, U128X W1, U138X W1,

U228x W1 and U238x W1 (see section 6.5)
6: LON-PE same as LON-ANA, plus energy is also calculated based on LON analog values (see section 6.5)
7: LON-INP binary inputs via LON for U1660
8: LON-REL relay outputs via LON for OCL210

Channel Names
A name can be assigned to each physical channel for improved identification. The name doesn't have to be unique, unless it will be used as a field name in a database. The character string has a maximum length of 8 characters, and has to
be at least one character long. ECL command: CHANNEL

E Unit, P Unit
A freely definable energy unit (e.g. kWh) and a power unit (e.g. kW) can be assigned to each physical channel. The character string has a maximum length of 4 characters, and has to be at least one character long. ECL command: EEINH, PEINH

(Channel) Visible
For each physical channel it can be specified whether or not it will be visible in the case of queries executed at the control panel or in "*" lists in the interpreter mode. This has no effect on the functioning of the channel! For example if only channels 1 to 3 are activated, you can only retrieve values from these 3 channels in the normal display – the device appears to have become a 3-channel unit. Even "Etot*", when queried in the interpreter mode, displays total energy from these three channels only. If all channels are shut down, date and time appear in the normal display. Entries become effective immediately and don't have to be acknowledged. ECL command: ONOFF

Start/Stop Channel
The acceptance of an input's meter pulses is controlled with the start/stop function. A channel generated with "differential coupling" can be influenced by means of an analog signal with the start/stop function. Due to the fact that a channel's binary input status is not influenced, this function can be used, for example, to avoid undesired counting of binary information. Entries become effective immediately and don't have to be acknowledged. ECL command: STARTSTOP (STSP)

Fixed Point
For each physical channel it can be specified with how many places after the decimal point energy or power values should be displayed (not calculated).
(0) no places after the decimal point0(2) two places after the decimal point0.00 (1) one place after the decimal point0.0(3) three places after the decimal point0.000 Entries become effective immediately and don't have to be acknowledged.
ECL command: CFIX C Factor
This makes the following possible, for example: The measured quantity is consumption in cubic meters. This should be displayed as standard cubic meters [Nm 3] which makes a correction factor necessary. The C factor is thus a multiplication factor for calculating the energy value of a channel.

Meter Constant
The meter constant can be separately defined for each of the physical channels. It indicates how many meter pulses a connected meter delivers per kWh and is used in the energy calculation formula (see page 11). ECL command: MCONST

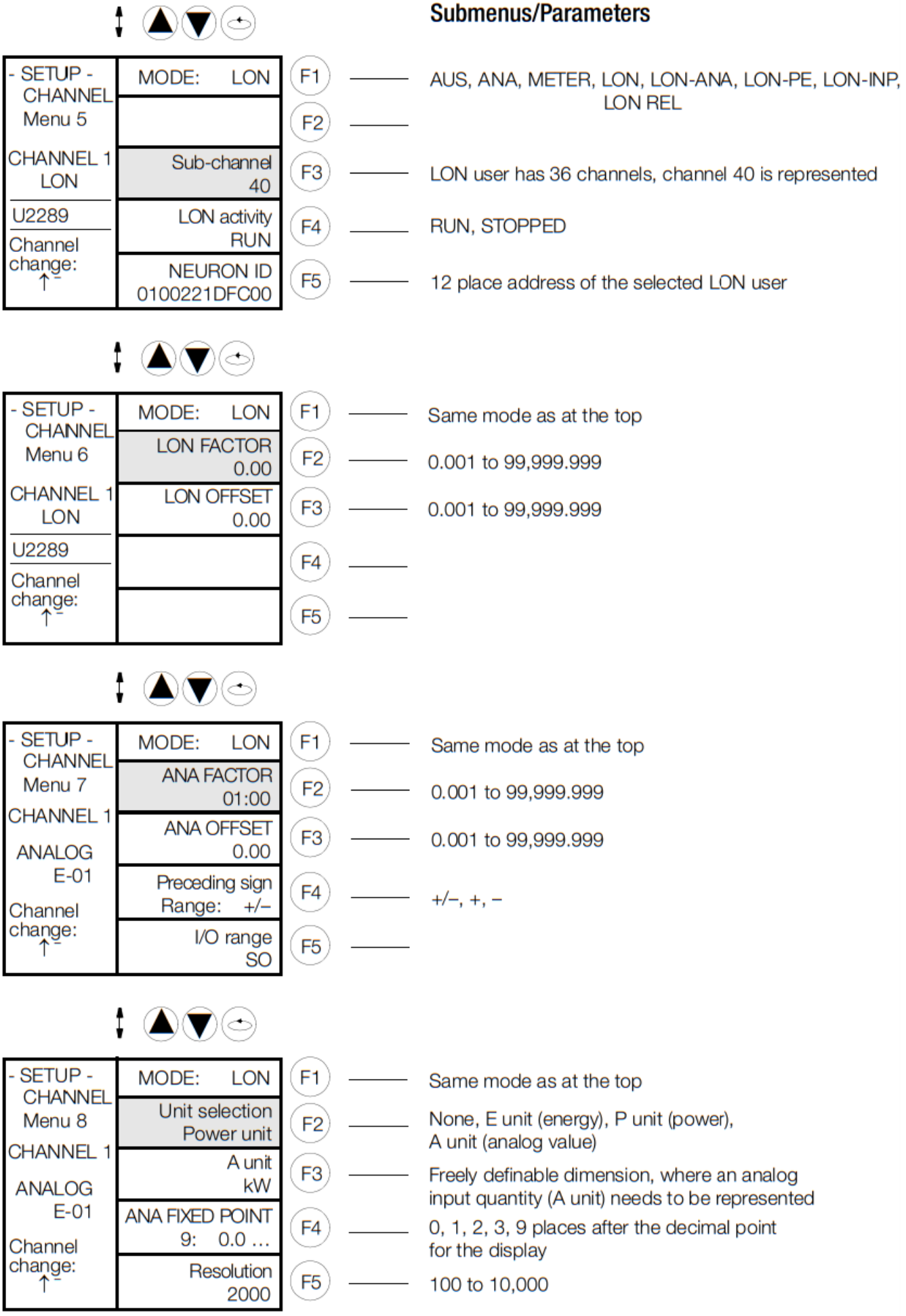
U Ratio, I Ratio
The factors for U ratio and I ratio can be separately defined for each of the physical channels. Calculation formula: see page 11. Change plus or minus sign: Press "<<" (F2) when the cursor is all the way to the left. Entry range for U ratio and I ratio: 0.000 to 99,999.999 A channel can be disabled for meter pulses by setting the Urat or Irat factor to zero. However, it's better to use the start/stop function. ECL command: URAT, IRAT

Note
Detailed descriptions of URAT and IRAT are included in the commands list (3348-870-01).

P Factor
The P factor can be separately defined for each of the physical channels. Calculation for- mula: see page 11. Change plus or minus sign: Press “<<” (F2) when the cursor is all the way to the left. Entry range for the P factor: 0.001 to 99,999.999. ECL command:
P FACTOR
Pulse Duration The duration for which a pulse must be applied to a channel’s S0 input in order to be recognized as an S0 pulse (debounce time). ECL command:
PULSE Edge
Specifies whether the meter pulse will be triggered at its positive (1) or negative (0) edge.
ECL command: EDGE

To Setup Channel Parameter (menus 5 to 8)

Submenus/Parameters



Mode

see page 37 above

LON Channel
LON user U2289 with the selected neuron ID has 36 channels. Of these, channel 40 (active energy import) is represented at local channel 1, when channel 1 is set to the LON mode.

LON Activity
The LON user can be shown (run) or hidden (stopped) with this function, without having to shut down individual channels.

Neuron ID
This is the globally unique address of a LON user and consists of a 12-place hexadecimal value. The summator automatically establishes contact with the LON user to which this address is assigned. If the local channel is set to the LON mode, the remote “LON CHANNEL” (channel 40 in the above example) is represented.

LON Factor, LON Offset
The values of LON users are standardized to a value of -1 … 0 … +1.
The characteristic range curve can be adapted as desired to the measuring task with the help of the LON factor and LON offset parameters. ECL commands: LONFACTOR, LONOFFSET.

ANA Factor, ANA Offset
The analog output values are standardized to a value of -1 … 0 … +1.
The characteristic range curve can be adapted as desired to the measuring task with the help of the Ma factor and Ma offset parameters. ECL commands: ANAFACTOR, ANAOFFSET.

Preceding Sign
Specifies the polarity of the on and off signals. And thus +/- corresponds to a positive/ negative signal of the respective input/output. ECL command: ANASSEL.

I/O Range
Specifies the ranges of the respective analog input. Possible ranges include: SO.

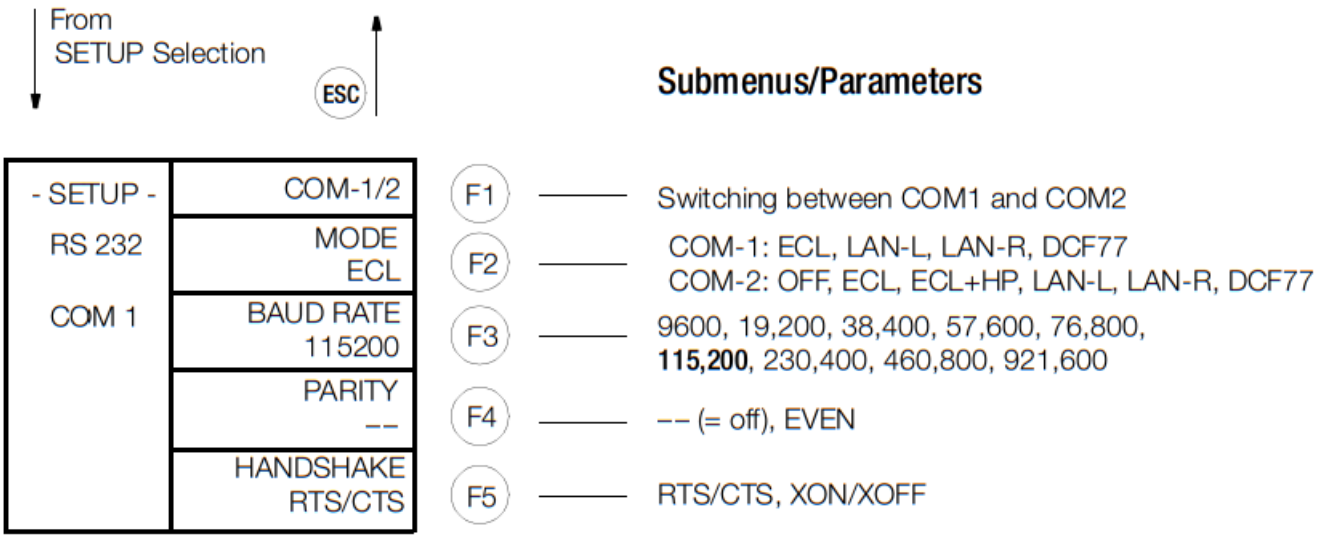
Unit Selection
Specifies in which unit the channel’s input quantity will be displayed (none, energy, power, analog value). ECL command: ANAUSEL

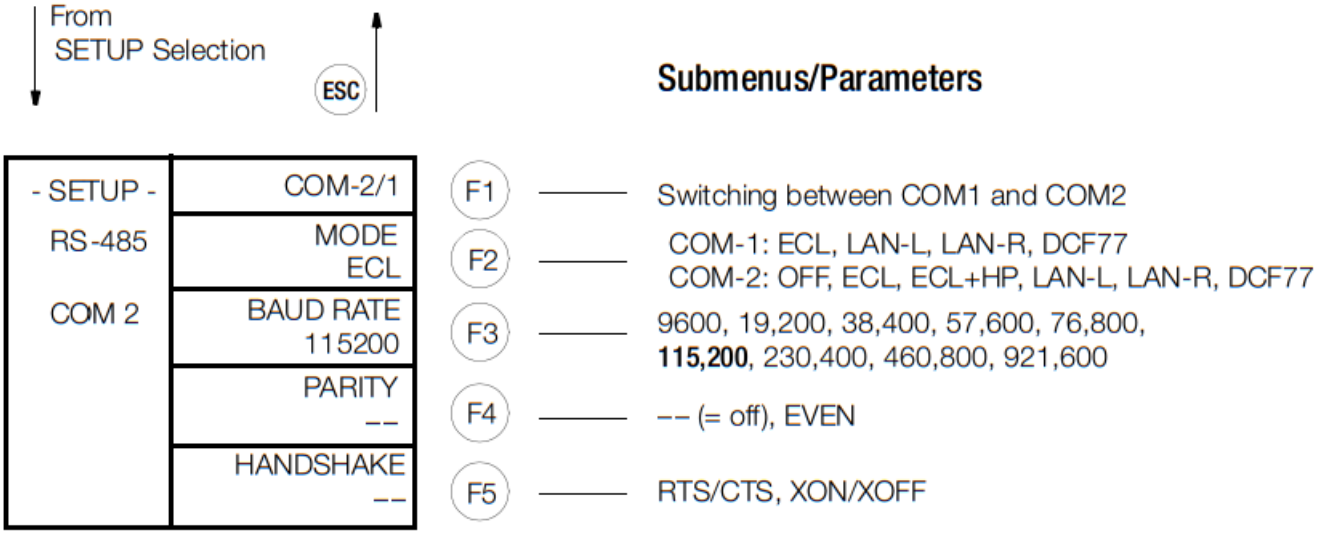
A Unit
Freely specifiable dimension for the representation of the measured quantity, if it’s measured as an analog value, e.g. kW, °C, m^3, mA. 5 places are possible. ECL command: AUNIT

AM Fixed Point
For each physical channel it can be specified with how many places after the decimal point the analog measured quantity should be displayed (not calculated).

(0) no places after the decimal point 0
(2) two places after the decimal point 0.00
(1) one place after the decimal point 0.0
(3) three places after the decimal point 0.000
(9) floating-point representation
Entries become effective immediately and don’t have to be acknowledged. ECL command: ANAFIX

Resolution
of the 12 analog input channels El to El 2. ECL command: ANARESO



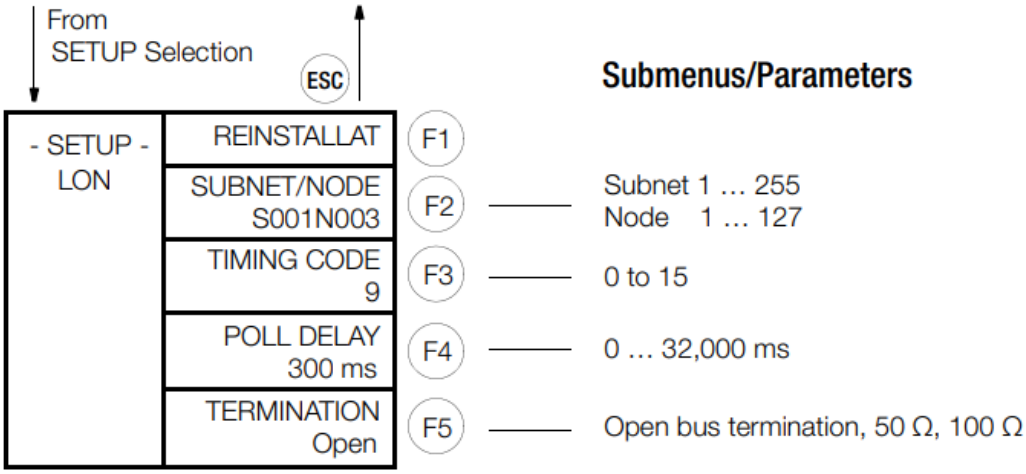


ECS LAN via COM

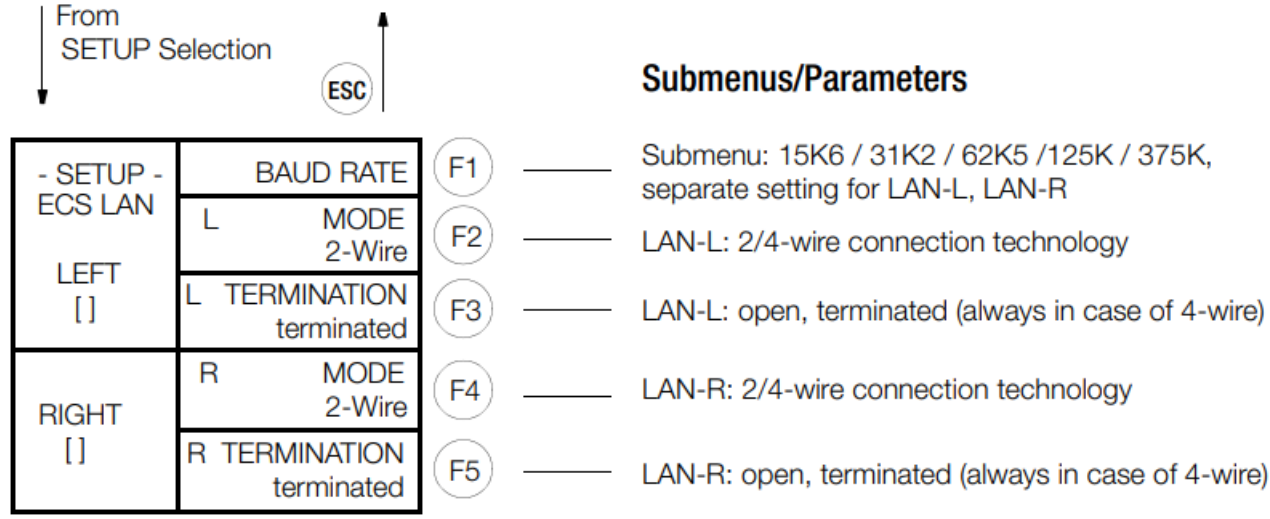
If a 4-wire ECS LAN connection has to be set up by means of an asynchronous V24 interface, a new mode is available for the serial ports as of V2.48:
LAN-R or LAN-L.
Example: Two devices need to be linked by means of a TCP/IP network at the ECS LAN level. Two COM servers are used to this end, each of which is connected to one device via RS 232 port and networked via Ethernet. COM servers forward characters transparently from the RS 232 port to the assigned COM server.
As soon as LAN-R or LAN-L is selected in the setup menu from COM-1 or COM-2, the ECS LAN data stream is redirected to this COM port. The interface parameters used by the COM port including baud rate, parity and handshake are then decisive, and not the previous ECS LAN settings any more.
Recommendation: highest baud rate (115,200), parity off, handshake RTS/CTS.
The selected settings must coincide with the settings of the interconnected COM server, but they can differ from those of the partner if necessary.
Please note that the currently unused ECS LAN may/should no longer be utilized. It must also be assured that the terminating resistor is activated for 2-wire parameters configuration, so that no ESC LAN errors can occur.

Special Case: Use of COM and ECS LAN Connection

The ECS LAN connection is shut down in the “ECS LAN via COM” mode. Outgoing frames are transmitted via the corresponding COM port, as well as via the ECS LAN port.
Incoming frames from both ports are processed. Nevertheless, this is not a star hub configuration, because the two ports (COM and ECS LAN) don’t “see” each other.



REINSTALLATion	All LON users are searched for and installed.
SUBNET/NODE	Summator's LON address
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 bus termination is set via TERMINATION.

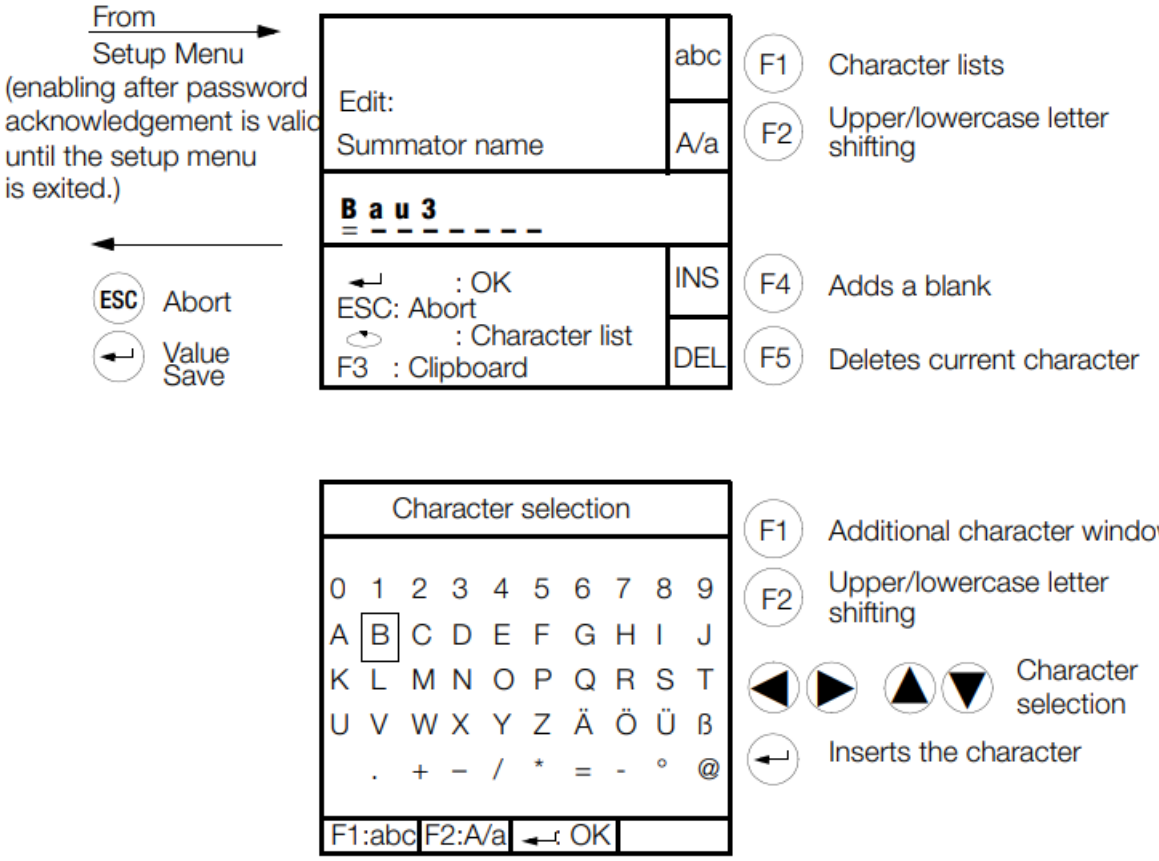


LAN-L: Settings for LAN left
LAN-R: Settings for LAN right

A 2-wire cable is normally used (terminals 45 and 46 or 49 and 50) – only in this way is bus configuration possible with several users on the same bus line. However, the integrated terminating resistors in the first and the last device on the bus line have to be activated to this end. Correct functioning of the bus is not possible without terminating resistors (bus LEDs LAN/L and LAN/R blink). For long transmission paths or where boosters are required, 4-wire transmission technology can also be used (only line-to-line connection is possible in this case). The required terminating resistors are activated automatically. The standard baud rate is 62.5 kBaud.

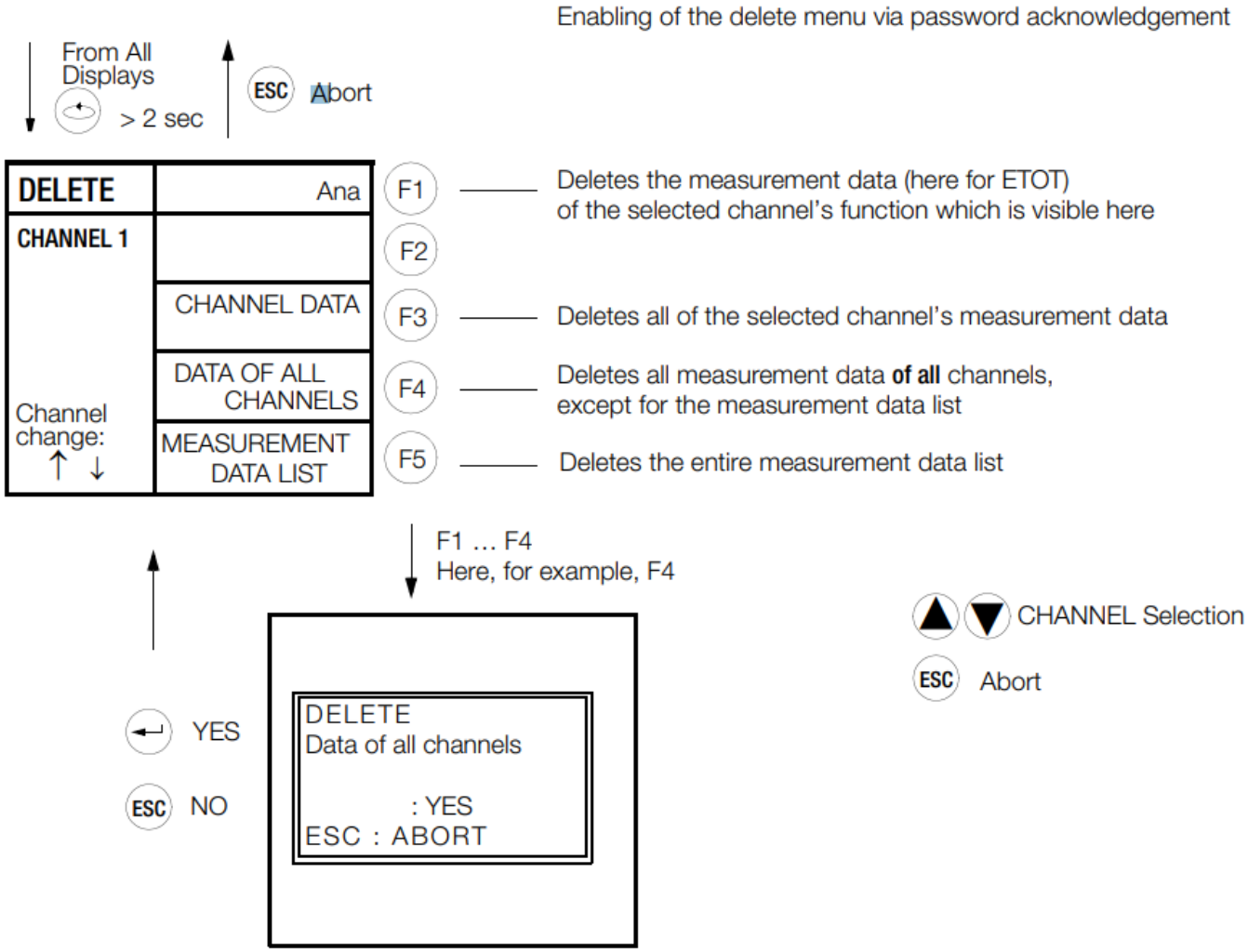
Note
Additional instructions on configuring the port (parameters of the SET… type) can also be found in the commands list (3-348-870-03).

7.7 SETUP Submenus (Edit, Delete, Outputs, Bootstrap Loader, Password)
EDIT Menu (example)

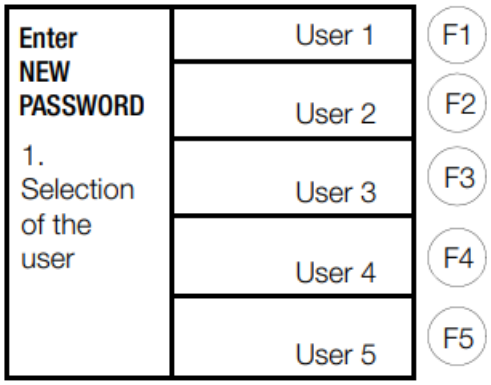


DELETE Men

Enabling of the delete menu via password acknowledgement



Password Menu

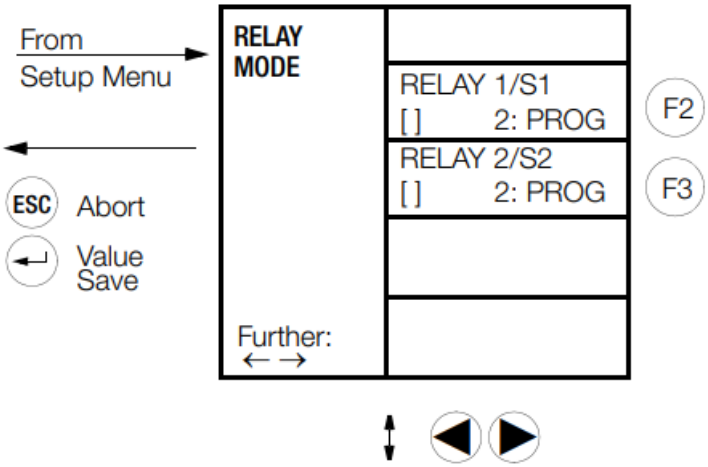


Passwords consist of a combination of F1 to F5 and must always have 6 places.

Upon delivery, all passwords have been deleted: all users can change parameter settings. If this needs to be prevented, you can enter passwords for 5 users: Enter a password for user 1 (master) first, after which you can then enter passwords for the other users (2 through 5). Afterwards, the device is open for 5 minutes without being operated. Thereafter, or after a device reset, user login is once again enabled. Each logged in user can change his or her password as desired. After logging in with the correct password, the user (only the logged in user) is able to make changes for 5 minutes even if none of the keys are activated.
If password protection should be eliminated for all users, user 1 (master) enters special password “111111”. The system deletes all passwords and parameter settings are enabled for all users.

Note
See also the commands list (3-348-870-01) concerning the password parameter.

S0/Relay Outputs Menu



7.8 Firmware Update Installing new firmware is only possible via the RS 232 COM-1 port. ECSUpdate.exe software with correctly configured INI file (ECSupdate.ini) is required on the PC. The previous program for the U1601/2/3 (Update32.exe) cannot be used. However, the new program supports old U1601/2/3 summators. In order for the ECSupdate.exe PC program to be able to install the firmware, the bootstrap loader mode has to be activated at the U1604. Proceed as follows to this end:

- Press and hold the SET key for 5 seconds, or hold it depressed while switching power on.
- LED 1 (the top LED) lights up (with brief inverting once per second) 115,200 baud.
- Other baud rates can be selected by repeatedly pressing the SET key. After pressing the key several times, selection starts over again at 115,200 baud (LED 1 lights up):

115,200	230,400	460,800	921,600	9,600	19,200	38,400
	S		S	S		
3			3	3	3	
			L	L	L	L

The correct firmware version is then selected with the PC program and the configuration of the COM port and the associated components is checked. Firmware uploading is started after acknowledging with OK.
The LEDs light up continuously during booting, and after several seconds (depending on the baud rate) they're interrupted repeatedly for roughly 1 to 2 seconds. After booting has been completed, the PC program automatically executes a reset and thus restarts the device.
If any problems should occur, this reset can also be forced at the device:
Reset: Press and hold the SET key until all LEDs go out or power off/on.
Caution: Partially uploaded firmware is not functional and must be fully uploaded without delay. Nevertheless, the bootstrap loader can generally be started even if the firmware is not functional.
Time required for booting depends on the selected baud rate (approximate values:
roughly 3 minutes at 115 kBaud and roughly 35 seconds at 921 kBaud).
Recommendation for selection of the ideal baud rate for the COM-1 port:

- If the PC is equipped with an integrated RS 232 port, the drivers (hardware) are usually not capable of using baud rates of 230 kBaud use 115,200 baud.
- If the USB – RS 232 converter cable (with FTDI chip directly in the USB plug) is used, the fastest available baud rate of 921,600 baud can (usually) be used without any trouble.

Using the Z302V Programming Cable
The cable requires corresponding Windows drivers which, depending on the Windows version, are installed automatically the first time it's connected to the PC.
In most cases the driver is installed automatically as of Windows 7, and in Windows 10 the driver is already on board.
If the driver has been installed correctly, the user only has to specify the desired COM port. The system automatically assigns a COM port number, which can or must be changed accordingly in the Device Manager.
This procedure is described in section 5 of the condensed operating instructions ("COM Settings") as well as in the following section. Here's an excerpt:
Device Manager
Connections (COM & LPT)

- —USB Serial Port (COM1)
- ——Properties of the USB Serial Port (COM1)
- ———Connection Settings Advanced …
- ————Advanced Settings for COM1
- —————Select COM1, COM2, COM3 …

  Please refer to the following web pages for more information on the drivers: **http://www.ftdichip.com/Drivers/VCP.htm**

  The easiest way to install the driver (32 and 64 bit) – if it's not installed automatically – is to use the setup executable available at the following address: **http://www.ftdichip.com/Drivers/CDM/CDM21228_Setup.zip**

COM1 (RS 232 full-duplex) default settings:
Baud rate: 115,200 baud (9600, 19,200, 38,400, 57,600, 76,800, 115,200, 230,400, 460,800, 921,600)

Handshake: RTS/CTS (-, RTS/CTS, XON/XOFF)
Parity OFF (off, even)
Mode: ECL (OFF, ECL, DCF …)

Attention!
Changes to the setting may render the device unusable, insofar as the faulty settings cannot be corrected via another correctly functioning interface.

Recommendation for selection of the ideal baud rate for the RS 232 – COM-1 port:

- If the PC is equipped with an integrated RS 232 port, the drivers (hardware) are usually not capable of using baud rates of 230 kBaud use 115,200 baud.
- If the USB – RS 232 converter cable (with FTDI chip directly in the USB plug) is used, the fastest available baud rate of 921,600 baud can (usually) be used without any trouble.
  Recommendation for selection of the ideal baud rate for the RS 485 – COM-2 port:
- This RS 485 port works in the half-duplex mode – no handshake is possible for which reason this function is always deactivated. And thus under certain circumstances, the baud rate must be selected such that no buffer overflow can occur (usually no problem with ECL protocol).
- With an FTDI chip-based USB – RS 485 converter, the fastest available baud rate of 921,600 baud can be used without any trouble.
  Tip: The COM port for FTDI-based USB – RS 485 converters can be permanently assigned in the device manager, and management of two or more virtual COM ports can thus be optimized:

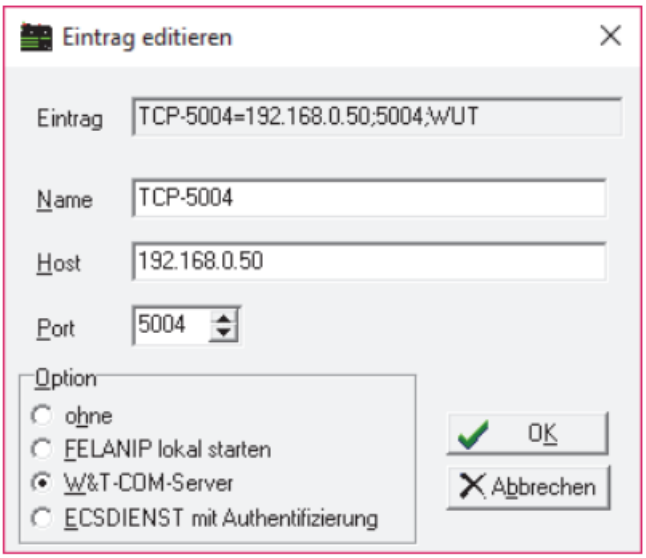
Device Manager

- —Connections (COM & LPT)
- —USB Serial Port (COM1)
- ——Properties of the USB Serial Port (COM1)
- ———Connection Settings Advanced …
- ————Advanced Settings for COM1
- —————Select COM1, COM2, COM3 …

7.10 Ethernet Port
In addition to the COM-1 and COM-2 ports, ECL inputs via TCP/IP are available as well.
After successfully opening one of the TCP-IP sockets from a PC, characters can be transmitted in both directions, as if connection had been established via a COM port (like a COM server).

Default IP Settings and Ports
IP address: 192.168.0.50
Netmask: 255.255.255.0
Gateway: 192.168.0.1
COM-4 port: 5004 (mode = ECL)
COM-5 port: 5005 (mode = ECL)

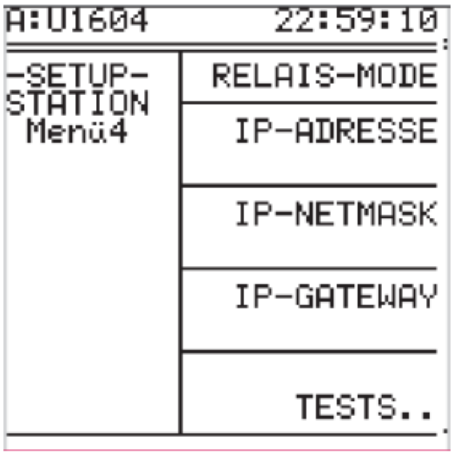
ECSWIN Settings
If ECSWIN is used, the “W&T-COM-Server” option must be selected.
This is the settings dialog box for COM-4 with the default settings:

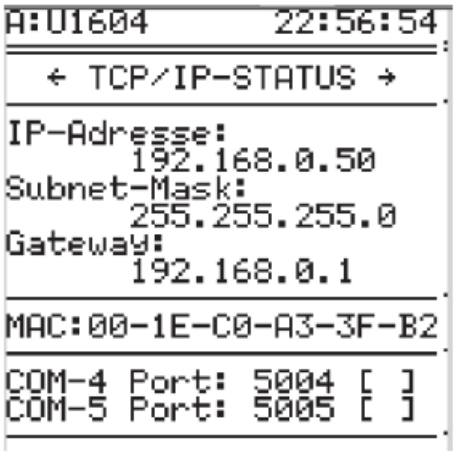


Useful ECL Commands for IP Management
Set IP: IP2UL 192.168.0.50, SYSIP = .
Set netmask: IP2UL 255.255.255.0, SYSIPNM = .
Set gateway: IP2UL 192.168.0.1, SYSIPGW = .
Note: These settings correspond to the default settings after a master reset.

Query MAC: SYSMAC48
Query IP: SYSIP% %rpw
Query netmask: SYSIPNM% %rpw
Query gateway: SYSIPGW% %rpw
Tip: “%rp” prints a long number as IP address: Sysip-, ! %rp!

TCP/IP Settings in the Control Panel
All adjustable IP parameters can also be set with the control panel – all IP parameters and the status of COM-4 … can be checked in the status view (see graphic above).





7.11 Relays and S0 Relays (S0-OUT)
The U1604 makes two S0 semiconductor relays (relay/S0-OUT 1+2) available:

U1604	Read/Write Status	Read/Write Relay Mode
Relay 1 / SO-OUT 1	REL 1 or SOREL 1	RELM 1
Relay 2 / SO-OUT 2	REL 2 or SOREL 2	RELM 2
Relay 3 (prepared)	REL 3	RELM 3
Relay 4 (prepared)	REL 4	RELM 4
Relay 5 (prepared)	REL 5	RELM 5
Relay 6 (prepared)	REL 6	RELM 6

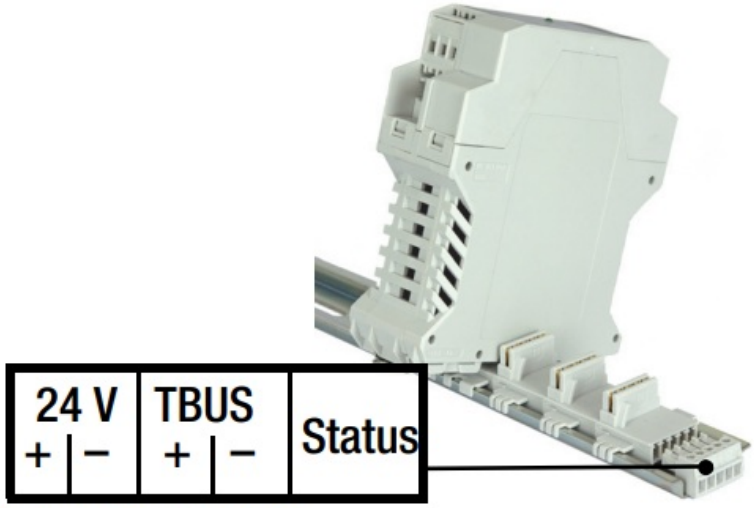
Comparison with U1601/3 (relays 1+2, S0 semiconductor relays 3 … 6):

U1601/3	Read/Write Status	Read/Write Relay Mode
Relay 1	REL 1	RELM 1
Relay 2	REL 2	RELM 2
S0-OUT 1	REL 3 or S0REL 1	RELM 3
S0-OUT 2	REL 4 or S0REL 2	RELM 4
S0-OUT 3	REL 5 or S0REL 3	RELM 5
S0-OUT 4	REL 6 or S0REL 4	RELM 6

The S0 relays are laid out as NO contacts (max. 50 V DC, 200 mA, bipolar). Assignment of the value 1 causes the S0 relay to close.
Assignment is made as follows: REL <rel> = {0, 1}
RELM <rel> = <mode> is used to set the relay's operating mode:
0→always off
1→always on
2→changeable (default)
Relays 3 through 6 have been prepared – values can be assigned and settings can be selected, but they don't have any effect.
S0 Pulse Output
Pulse sequences can be read out with the S0 relays which generate equivalent S0-compatible pulses in accordance with the change to the energy value of a given channel (1 … 64).
Associated commands:
S0PCH <rel> = <source_channel> (specifies the target relay and the source channel)
S0PDELTA <rel> = <energy_per_pulse> (indicates the energy quantum for which 1 pulse is generated)
S0PMS <rel> = <pulse_duration_ms> (duration of one pulse in ms)

Mapping the Status of the U1604 to Relay 1 or Relay 2
When the U1604 basic module is used without the U1614 power pack module and external 24 V auxiliary power is fed directly via the TBUS, no status relay is available. In order to make a status output available for this configuration, the status of the U1604 can be mapped to relay 1 or 2.

Left	Top	Right
	TBUS STATUS	
	TBUS–	
	TBUS+	
	GND	
	+24 V	



Supplying 24 V DC Auxiliary Power Directly via the TBUS

Supplying 24 V DC Auxiliary Power Directly via the TBUS
The status is mapped via a so-called feature.
Features are stored to non-volatile memory at the U1604 and are not deleted in the event of a simple or an extended master reset.
Activating status mapping to relay 1: STATRELMAP FEATURE = 1
Activating status mapping to relay 2: STATRELMAP FEATURE = 2
Deactivating status mapping (default): STATRELMAP FEATURE = 0
Querying all active features / all available features: FEATURES// list of all active features
FEATURES * // list of all possible features

Notes:

- Features are usually not part of the summator's parameters configuration.
- The command is: FEATURE
- As soon as mapping is active, the status of the affected relay is controlled internally via
  RELMode (0:OFF STATUS ERROR, 1:ON STATUS OK).
  RELM assignments are possible but have no effect.
  The value of REL is not affected by mapping – it can be changed via assignment but without effect.
  – RELM of a mapped relay cannot be changed in the SUMMATOR setup menu – menu 4 – RELAY MODE – "[0] STATUS" or "[1] STATUS" is displayed.

Attention!
If 24 V DC auxiliary power is supplied externally, the U1614 power pack module may not be used!

7.12 Basic Software Configuration
Upon shipment from the factory or after a master reset, the device is configured as follows:

Designation		Parameter	Value
Summator name		SUMMATOR	U1604
Designation		SET1D	A
Synchronizing interval		INTERVAL	15 minutes
Interval source		10	Time

‘Tariff source		TS	Program
Tariff unit		TUNIT	EUR
Tariff Ned point		TAX	2
Cost factor, tariff 1		COSTFAC1	0.20
Cost factor, tariff 2		COSTFAC2	0.15
Password		PASSWORD	
LCD contrast		–	5
Language selection		Language	German
Relay mode		RELM	2 (per program)
Level		LEVEL	1
Channel mode		CMODE	Channel 1 … 12: METER 13 … 14: ANA 15 … 64: OFF
Channel name		CNAME	Channel x
Long name		LNAME	Long name, channel x
Energy unit		EUNFT	kWh
Power unit		PUNIT	kW
Visible		ONOFF	ON
Start/stop function		STARTSTOP	START
Channel fixed point		CFIX	2
C Factor		CFACTOR	1
Meter constant		MCONST	1
Voltage transformer transformation ratio		URAT	1
Current transformer transformation ratio		RAT	1
P factor		PFACTOR	3600
Pulse duration		PULSE	20 ms
Edge		EDGE	1 (+)
LON activity		LONSTOP	0
Neuron ID		LONID	0
LON terminating resistor	*	SetLON	50 K2 / 100 K2 / OFF
LON SUBNET/NODE	*	LonSUBNODE	SOO1N126 (subnet =1, node =126)
LON TIMING CODE		LonSTATI1Ming	9 (384 ms)
LON POLL DELAY		LonPOLLDELay	0

LON sub-channel		LONCHAN	1
LON factor		LONFACTOR	1
LON offset		LONOFFSET	0

Designation		Parameter	Value
C factor		CFACTOR	1
Ma factor		ANAFACTOR	1
Ma offset		ANAOFFSET	0
Ma sign		ANASSEL	0 (±)
Select ana unit		ANAUSEL	2
Ma unit		AUNIT	kW
Ma mode		ANAMODE	3 (meter)
VO range	*	ANAMODSEL	3 (50)
Ma fixed 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	Xori/Xoff
ECS LAN 2/4-wire connection		SetLanL, SetLanR	BL:2-wire, BR:2-wire
ECS LAN terminating resistor	‘	SetLanL, SetLanR	BL:On, BR: On
ECS LAN baud rate		SetLanL, SetLanR	BL: 62K5, BR: 62K5
Background program: Daylight savings / standard ti me		H 31	1SUW1,1F,TIME-,+,time..’
Formatting		FORMAT	Channels 1 … 64 in format 0
Group name		GROUP	ECS
Status relay coupling		STATCHECK	1 (coupled)

* These parameters are not changed when a master reset is executed.

Terminal Assignments

The SU1604 is equipped exclusively with plug-in connector terminals.
The following terminal types (color: gray with screw connector) are used and are manufactured by PHOENIX-CONTACT (PC):

- 3-pole, 5 mm grid (PC 1971947), used in U1614 power pack module
- 4-pole, 5 mm grid (PC 1878037), used in U1604 and U1624
- 5-pole, 3.5 mm grid (PC 1769087), used in U1604 (RS 232)
- 5-pole, 3.81 mm grid (for TBUS connection), right (PC 1719697) or left variant (PC 1719707)

8.1 U1614 Power Pack Module

24 V DC Output			
+24V	0V	0V	Max. 5 W

24 V DC OUT
– Up to 5 W at 24 V DC can be taken from this 3-pole terminal.
Total output power of the U1614 power pack module is 20 W.
– +24 V and the two jumpered 0 V terminals are connected to internal 24 V DC supply power (TBUS +24 V terminal and GND = 0 V).
STATUS REL
– 3-pole terminal for the status relay, can be energized with 250 V AC, 5 A, relay contacts: AgNi 90/10
– In the case of STATUS OK, the relay is pulled out and COM is connected to NO. In the off state or in the case of STATUS ERROR, COM is connected to NC.
UA IN
– 3-pole terminal for connecting auxiliary power UA
– Reliable UA range:
90 … 264 V AC,
120 … 300 V DC / 40 VA

8.2 U1604 Basic Module

COM2 (RS 485)				LON			
TR+	TR–	Term–	Term+	A	B		

COM1 (RS 232)				
TX	RX	RTS	CTS	GND

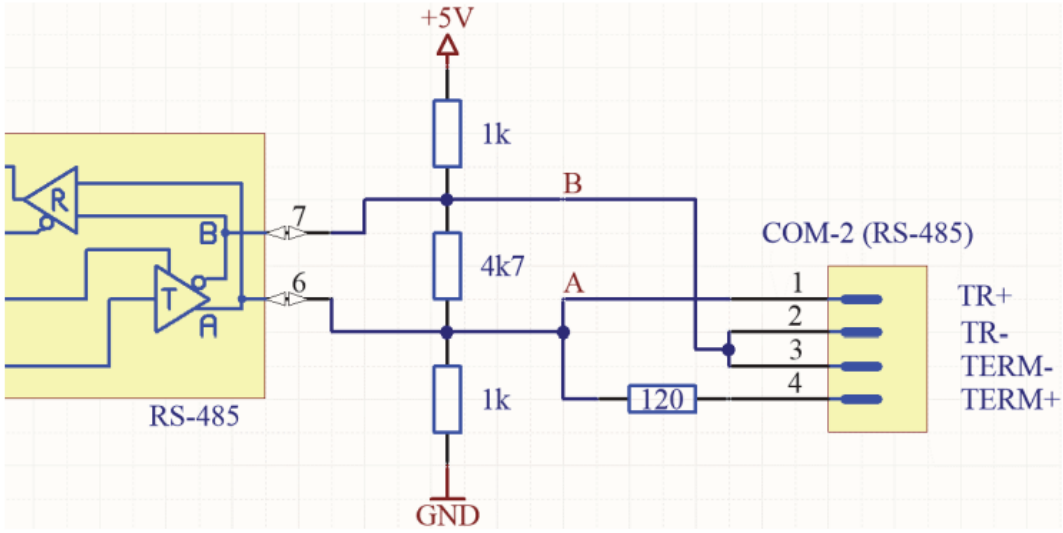
LAN L			
IO+	IO–	I+	I–

LAN R				S0 OUT 1		S0 OUT 2	
IO+	IO–	I+	I–	(a)	(b)	(a)	(b)

COM2 (RS 485)

- 4-pole connector terminal for the RS 485 port (half-duplex).
- A defined quiescent level is assured internally by resistors 1K/4K7/1K.

- 120 terminating resistor is connected between TR+ (A) and TR– (B) by connecting Term- to Term+.



COM1 (RS 232)

- 5-pole connector terminal (3.5 mm terminal grid) for the RS 232 port (full-duplex).
- A USB-COM adapter cable is available which can be directly connected to this terminal.

LAN L and LAN R

- 4-pole connector terminal for the LON network – only A and B are used (polarity is irrelevant).
- The LON matching resistor is relay controlled (50 Ω/ 100 Ω/off).
  S0 Out 1+2 (semiconductor relays)
- Current-carrying capacity: max. 50 V DC, 200 mA, bipolar
- Relay ON→(a) connected to (b) (typically 1 Ω, max. 10 Ω).

S0 IN 1 … 12

- Six 4-pole connector terminals for two S0 inputs each.
- S0 input characteristics:
  Input voltage = max. 30 V, input resistance = 5.1 k, bipolar, electrically isolated
- Due to the fact that the utilized optocouplers are bipolar, connection polarity is irrelevant.

8.4 TBUS Connection

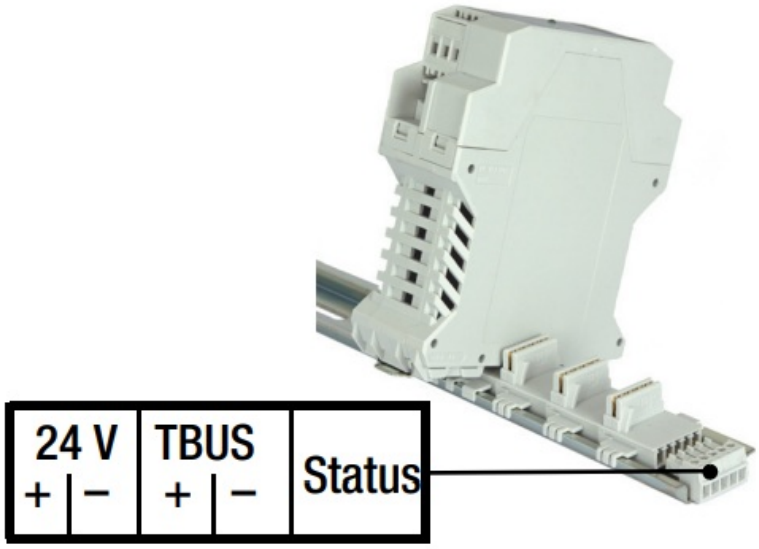
The 5-pole TBUS is used to connected all SU1604 modules to each other. This connection is implemented by means of TBUS connectors which are included with each device and are snapped into the top-hat rail after plugging them together. The individual components are then latched onto the top-hat rail at the corresponding position. This procedure connects the devices to each other

- no wiring is required. In certain applications it may be necessary to:
- Use a special power pack instead of the U1614 power pack module .
- Connect the TBUS from one top-hat rail to another
- Operate two or more U1604 basic modules with one U1614 power pack module

Attention!

During operation when auxiliary power is active, neither the U1604 basic module nor any other S0 modules may be mounted to or removed from the TBUS.
In these cases connection to the TBUS is accomplished with special 5-pole terminals (3.81 mm grid), which differ for right (PS 1719697) and left (PC 1719707) connection.

Left	Top	Right
	TBUS STATUS	
	TBUS–	
	TBUS+	
	GND	
	+24 V	



+24V, GND
– 24 V DC power supply to all TBUS devices
TBUS+, TBUS–
RS 485 communication connection between U1604 and TBUS components
STATUS

- Control line for the status relay in the U1614 power pack module.
- Connected to 5 V by the U1604 basic module via pull-up resistor (STATUS OK) and to GND via N-FET in the case of STATUS ERROR. This makes it possible for all TBUS components to force the STATUS ERROR state.
- The following applies for the status relay in the U1614 power pack module:
  STATUS OK (relay picked up), if UTBUS-STATUS 2.7 V
  STATUS ERROR (relay dropped out), if UTBUS-STATUS < 0.8 V or open

Connecting the protective earth conductor:

- The DIN top-hat rail must be securely connected to PE!
- The individual TBUS components are automatically connected to earth potential on the top-hat rail via a contact in the housing.
- BUS GND does not have a low-impedance connection to PE, except for interference suppression with 1 nF/1 kV capacitors and protection against excessively high potential differences with a 275 V varistor in the U1614 power pack module between GND and PE.

Distributing a system to two separate top-hat rails:

U1614 Power	U1604 Basic module	U1624 S0IN12	U1624 S0IN12		U1624 S0IN12	U1624 S0IN12	U1624 S0IN12	U1624 S0IN12
TBUS STATUS				⟷	TBUS STATUS			
TBUS–				⟷	TBUS–			
TBUS+				⟷	TBUS+			
GND				⟶	GND			
+24 V				⟶	+24 V			

One U1614 power pack module supplies two independent SU1604 systems:

U1614 Power	U1604 Basic1	U1624 S0IN12	U1624 S0IN12		U1604 Basic2	U1624 S0IN12	U1624 S0IN12	U1624 S0IN12
TBUS STATUS				⟷	TBUS STATUS			
TBUS–				X	TBUS–			
TBUS+				X	TBUS+			
GND				⟶	GND			
+24 V				⟶	+24 V			

Use of an External Power Pack

U1604 Basic1	U1624 S0IN12	U1624 S0IN12	U1624 S0IN12		External Power Pack
TBUS STATUS					
TBUS–					
TBUS+					Output: 24 V DC
GND				⟵	0 V
+24 V				⟵	+24 V

- Without the U1614 power pack module there's no 3-pole status relay. Nevertheless, one of the U1604 basic module's two S0-OUT semiconductor relays can be used as a status relay.
- See "Mapping the Status of the U1604 to Relay 1 or Relay 2" on page 52 in this regard.
- The nominal input voltage range of the TBUS connections for +24 V and GND (UATBUS) is 24 V – the connections are protected against polarity reversal.
  The permissible voltage range is: 9 V UATBUS 30 V.

⚠Attention!
If 24 V DC auxiliary power is supplied externally, the U1614 power pack module may not be used!

Programming

General Information

ECL — Energy Control Language

The flexibility of the ECS is based on the programmability of the individual summators using the ECL programming language (energy control language), which was specially developed for the ECS. Refer to the operating instructions for the ECL interpreter and the commands list for further information concerning this high-level language which is similar to **FORTH** but, like BASIC, is easy to learn. Thanks to this programmability, the following additional system characteristics are made available:

Virtual Channels

Even complex formulas for the creation of virtual channels can be clearly and concisely formulated as background programs. There's no predetermined schema which inhibits flexibility.

Programming the Relays
Relay switching can depend on numerous conditions. With ECL, any desired conditions can be formulated, even cross-summator conditions. The conditions are evaluated continuously as a background program. Simple energy management, for example, can involve a special type of relay output programming.

Simple Energy Management
Example: If a consumer's mean power exceeds a given value, the consumer is shut down by switching one of the 2 relays. Whether or not this shutdown is at all desirable can be ascertained by checking system time (e.g. only at night), by polling a binary input (e.g. only switch when logical one is applied to input 10) or by evaluating the power values of other consumers.

Tariff Changeovers
Time comparison functions in background programs make it possible to respond to special requirements for tariff changeovers.

Flexible Adaptation to Database–Specific Transmission Formats
Continuously recurring queries of datasets can be saved as a normal P program. Entirely ASCII-oriented database formats can be compiled in a program of this sort. Data transmission is started in accordance with the desired format after invoking this program.

Background Programs HO … H31
32 background programs are available, namely HO … H31. Each program can take on up to 127 characters. The background programs are executed in the background, one after the other. Thanks to the operating system's multitasking structure, the background programs have absolutely no effect on the normal operating sequence.

Programs PO … P31 and 00 … 031
64 programs, namely PO … P31 and 00 … 031, receive continuously recurring command inputs which can then be processed by simply invoking the corresponding program. Nesting of programs is possible, and a normal P program can be executed as a subprogram from a background program.

Program Names
Names can be assigned to P programs. P programs can be addressed system-wide with their names.

Parameters Configuration and Data Visualization at a PC
The easiest way to communicate with a summator from a PC is via terminal emulation, e.g. with the help of HyperTen¯ninal. However, adequate knowledge of the commands is absolutely essential.
ECSwin provides a much more convenient method:

Program features:
ECSwin is used primarily for configuring parameters at U1600, U1601, U1602, U1603, U1604 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 (online displays) is supported as well. The 32-bit program (as of V3.4.x) runs under MS Windows Vista and 7 (32 and 64-bit), as well as 8 and 10. Connection to the U16xx is possible via TCP/IP or RS 232.

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
- Transfer user created commands to the summator
- A dialog box for generating virtual channels
- Control panel display (including device display, keys and LEDs) for U1600, U1601 and U1604
- Ascertainment and graphic representation of ECS LAN network topology
- Querying and display (as table or characteristic curve) of intervallic, daily, monthly and annual energy and power data which have been stored to memory at the summator.
- Querying and graphic display of currently measured values in data logger format
- Data transmission via modem (maintenance of a dial-up list)
- Terminal emulation

9.3 ECL Extensions and Notes on Compatibility

This section includes extensions to the ECL interpreter language as well as notes concerning compatibility.

Addressing Up to 255 Devices in the ECS LAN System

ECL permits direct addressing of up to 255 devices in the ECS LAN system by placing the device ID (A:,A1:… A9:,B:,B1…B9:,…,Z:,Z1:…Z4:) in front of the command. Example for querying the firmware version of devices A1: and C7:

A1 : VER, C7 : VER

The so-called “local” device, which is connected to the PC directly via the RS 232 or TCP/IP port, can be directly addressed with special ID AA:, without having to know the exact ID.

The default context is normally set to the local device, so that use of special ID AA: is only necessary in exceptional cases. This is usually made apparent in the terminal programs by means of a prompt at the beginning of the line in the form of “<A>” for device A:.

Examples (do not enter prompt <A> – it’s generated by the terminal program): <A> VER

- read out version information from device A: <A> ALL, VER
- read out version information from all available devices

  <A> C1: VER, EGES 1 VER read-out from device C1: and read-out of ETOT 1 from device A: (change of device context one-time only for C1:)

  <A> C1: , VER, EGES 1 VER read-out and read-out of ETOT 1 from device C1: (C1: becomes line context – valid through the end of the line)

  <A> C1: , VER, AA : ETOT 1 VER read-out from device C1: and ETOT 1 from device A: (although C1. becomes line context, special ID AA: applies to ETOT A:)

Differentiation Amongst Local and Remote Devices

In the case of varying firmware and/or device types within the ECS LAN system, it’s important to differentiate amongst “local” and so-called “remote” devices and summators. Which devices are responsible for the transmission of data between these via the ECSLAN is usually irrelevant, although of course data throughput can differ significantly depending on device type. The ECL command interpreter always runs at the local summator, and must therefore be capable of understanding all of the commands used in the command line. If it doesn’t know one of the commands, this results in a SYNTAX ERROR.

- For example in a system comprised of U1600, U1601/2/2/3 and U1604 summators, all of the commands of a “remote” U1600 summator can be processed by a U1604 summator which functions as the “local” summator (downward compatibility).
- But this doesn’t work the other way around when the U1600 is the “local” summator and the U1604 is the

"remote" summator. All of the commands from the U1604 summator which are unknown to the U1600 summator result in errors. Nevertheless, all of the commands known to the U1600 can be executed on/with a remote U1604 (limited upward compatibility).

Note: There are also command groups such as SYS, LON, REC etc. which fundamentally have to be known by the local summator, although the exact command (e.g. SYSIP) is first interpreted by the remote summator. The terms local device and remote device have been explained here in detail because they have to be used again and again in the following sections in order to illustrate complicated internal relationships.

9.4 INDEX Command Bug for U1601/2/3 with Use of UTC

The INDEX command is used for a time search in order to find a certain entry in the interval measurement data list. The bug in U1601/2/3 firmware as of V2.48 described below was detected and eliminated in June 2017.
Insofar as all summators within the ECS LAN system work exclusively with local time (in which case the following applies: UTCTZ = 0 and UTCDST = 0), the INDEX command functions flawlessly.
But as soon as UTC time is used system-wide (for example Germany: UTCTZ = 1, UTCDST = 1), the INDEX command doesn't find the right entry if a local time is searched for with the time search and the addressed summator is a U1601/2/3 with firmware (RA) older than June 2017. In this case, the result of INDEX <time specification> erroneously corresponds precisely to the results of INDEX° <time specification>.
If a UTC is searched for (with the "°" extension), the entire system functions flawlessly. This also applies to U1600 summators, which have to be set to local time for systemwide UTC time processing because they don't offer any internal UTC time processing.

	System Time	U1604	U1601/2/3 FW as of V2.57	U1601/2/3 FW up to V2.56	U1600
INDEX with local time search	UTC			ERROR!	Not possible
INDEX° with UTC time search	UTC				9
INDEX with local time search 10	Local				

Notes
– System time UTC means that all real-time clocks (RTCs) are set to UTC time and all (local) time specifications are converted in accordance with the time zone (UTCTZ) and the daylight savings time setting (UTCDST).
Internal timestamps are always in UTC and are thus strictly monotonic increasing, regardless of any changeovers between daylight savings and standard time.

Technical Data

Binary Inputs

U1624 S0 – Inputs, 12-Channel S0IN12	
Input quantity	Direct current, bipolar (square-wave pulses, S0-compatible)
Design	Electrically isolated
Input voltage	Max. 30 V
Input resistance	5.1 kΩ

Auxiliary Power Supply

U1614 — Power Pack Module with Br oad Range AC/DC Input	
Nominal range of use, AC	90 V … 264 V
Frequency	47 … 440 Hz
Nominal range of use, DC	120 V … 300 V DC
Efficiency	83%
DC output Voltage tolerance	Max. 24 V, 5 W ±2%
Total DC output power	Max. 24 V, 20 W (including DC output)
Power consumption U1604 (basic module) U1624 (12 ea. SO input)	Max. 40 VA 5 W 1 W
Fuse	T 1.6 A/250 V AC, 300 V DC (20 mm)
Overvoltage category:	II
Protection category:	II
Test voltage: (alternating voltage, 1 mi n.) Input — housing: AC auxiliary voltage input — input: Stat us relay (U1614) — input: SO semiconductor output (U1604) — i nput: Interfaces — input:	 0.5 kV 3.0 kV 3.0 kV 0.5 kV 0.5 kV
Status relay	250 V AC, 5 A, 3-pole, AgNi 90/10

Memory

MRAM – TRTC	
MRAM Data retention	4MB > 20 years (data retention INDEPENDENT of RTC backup battery)
RTC real-time clock Follow-up time Accuracy Backup battery for RTC Service life	 >10 years 5 ±5ppm (0 … +10ppm) Lithium battery, 3 V ½ AA installed to PCB > 10 years, battery replacement typically unnecessary

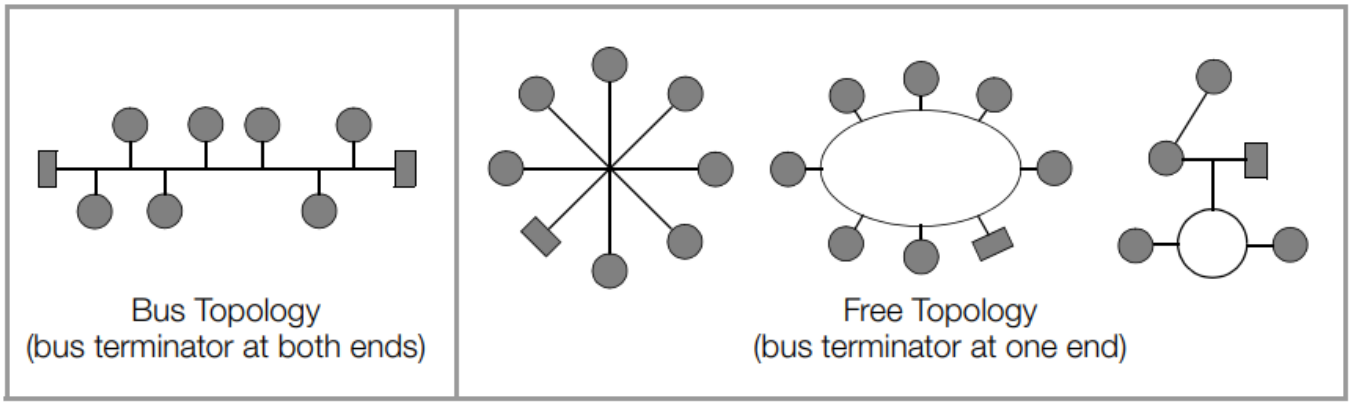
Outputs

Relay Outputs	
2 S0 semiconductor relays (U1604)	Max. 50 V DC, 200 mA, bipolar
Status relay (U11614)	250 V AC, 5 A, 3-pole, AgNi 90/10

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 (Si) 112 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 × 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 … 4 summator via the LON network. The summator is capable of interacting with the following LON-compatible devices:

• Multifunctional power meter	A2000, A210, A230
• Programmable multi-transducer	DME400
• Electric meters	U1681, U1687, U1689, U128x W1, U138x W1, U228x W1, U238x W1
• 8-channel (S0) meter polling module	U1660
• 6-channel analog input module	U1661
• 6-channel relay output module	OCL210

12.1 Network Interface

So-called binding is generally required in order to enable communication amongst LON devices. This means that network-variable outputs are connected (bound) to networkvariable inputs with the help of a tool. Binding is not required for the U1604, 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 U1604 continuously acquires meter readings and power values from the LON devices. A delta value is generated based on 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 not 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#	Designation	Description	Nv#	Designation	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 FIT	27	nvoWatTot	Active power in the network
54	NvoWHTotImpHT	Active energy import FIT	27	nvoWatTot	Active power in the network
58	NvoVarIfrotExpLT	Reactive energy export LT	35	nvoVarTot	Reactive power in the network
59	NvoVarIflotImpLT	Reactive energy import LT	35	nvoVarTot	Reactive power in the network
60	NvoVarIflotExpHT	Reactive energy export FIT	35	nvoVarTot	Reactive power in the network
61	NvoVarIflotImpHT	Reactive energy import FIT	35	nvoVarTot	Reactive power in the network

Only the LTHT setting of the A2000 is supported (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 ofmeasure.
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#	Designation	Description	Nv#	Designation	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.

Maintenance

Battery Maintenance
The integrated backup battery (MnO2 Li button cell) is easy to replace with the help of the sliding cover on the top of the device. The cover is removed from the screw mounting to this end. The rounding of the cover and its angled lug are precisely matched to the but- ton cell. After the cover has been set onto the button cell and the lug has snapped into place, the cell can be removed by gently pulling the cover.
A new button cell (only type CR2450 is approved) can then be gently pressed into the battery holder.
Attention: When changing the battery, use only the sliding cover intended for this purpose and do not insert it into the housing next to the battery! Refer to “Returns and Environmentally Sound Disposal” on page 81 concerning battery disposal.

Contact, Support and Service

Repair and Replacement Parts Service
DAkkS Calibration Center and Rental Instrument Service
If required please contact:
GMC-I Service GmbH
Service Center
Beuthener Str. 41
90471 Nürnberg, Germany
Phone: +49 911 817718-0
Fax: +49 911 817718-253
e-mail: **service@gossenmetrawatt.com**
www.gmci-service.com
This address is only valid in Germany. Please contact our representatives or subsidiaries for service in other countries.
Industrial Product Support
If required please contact:

Gossen Metrawatt GmbH
Industrial Product Support Hotline
Phone: +49-911-8602-0
Fax: +49-911-8602-340
e-mail: support.industrie@gossenmetrawatt.com

Returns and Environmentally Sound Disposal

This instrument is subject to directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE) and its German national equivalent implemented as the Waste Electrical and Electronic Equipment Act (ElektroG) on the marketing, return and environmentally sound disposal of electrical and electronic equipment. The device is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Waste Electrical and Electronic Equipment Act).
The symbol at the left indicates that this device and its electronic accessories must be disposed of in accordance with applicable legal regulations, and not together with household trash. In order to dispose of the instrument, bring it to a designated collection point or contact our product support department.

This instrument is also subject to directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and its German national equivalent implemented as the Battery Act (BattG) on the marketing, return and environmentally sound disposal of batteries and accumulators.
The symbol at the left indicates that batteries and rechargeable batteries must be disposed of in accordance with applicable legal regulations. Batteries and rechargeable batteries may not be disposed of with household trash. In order to dispose of the batteries or rechargeable batteries, remove them from the instrument and bring them to a designated collection point.
Segregated disposal and recycling conserves resources and protects our health and the environment.
Current and further information is available on our website at http://www.gossenmetrawatt.com under the search terms “WEEE” and “environmental protection”.

Documents / Resources

	GOSSEN METRAWATT SU1604 Summation Transformer [pdf] Instruction Manual SU1604 Summation Transformer, SU1604, Summation Transformer, Transformer

References

- trawatt.com
- VCP Drivers - FTDI
- Servicepartner für Kalibrierungen, Reparaturen, Ersatzteile, Mietgeräte | GOSSEN METRAWATT GMC-I Service GmbH
- GOSSEN METRAWATT, GMC-I Messtechnik, GMC-Instruments

Manuals+,