

# SACO 16A3

## Analogue input annunciator

User's manual and Technical description



Data subject to change without notice

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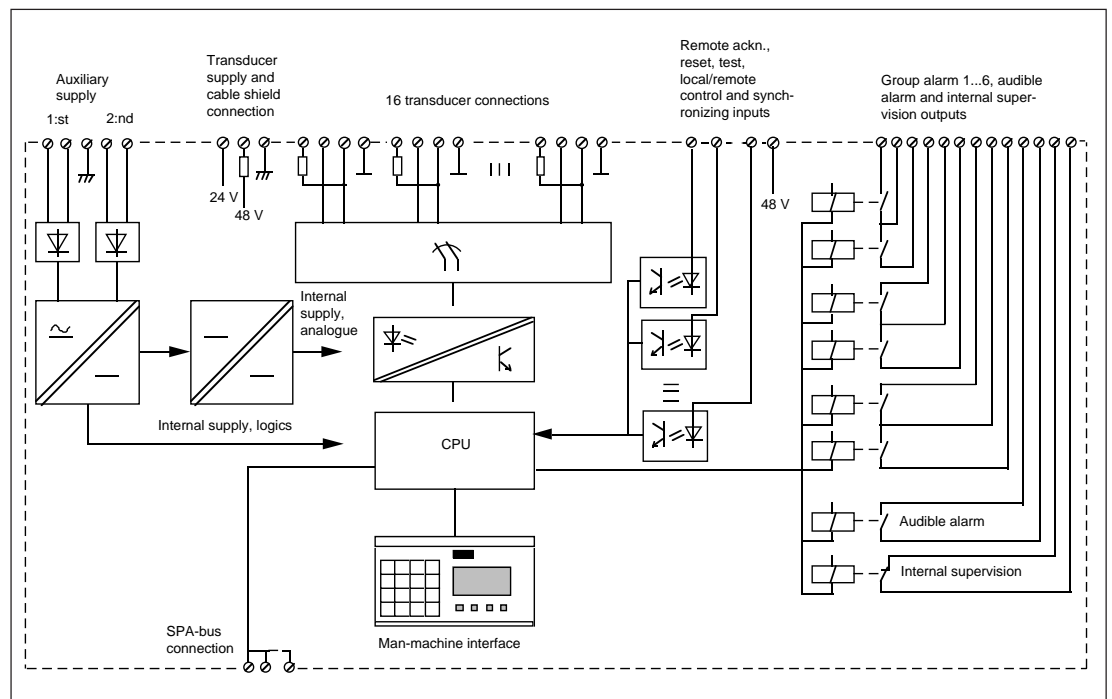
<b>Features</b>	<p>Stand-alone, off-the-shelf annunciator unit for analogue input signals or field contact signals.</p> <p>Four digit alpha-numerical display and a 64x120 LCD dot matrix display for local data presentation.</p> <p>Serial port for connection of the annunciator unit to the fibre-optic SPA bus and further to the hierarchically higher level data acquisition and reporting system or remote control system.</p> <p>36 standardized, fully field-selectable channel input signal ranges.</p>	<p>Four adjustable alarm or trip set-points per channel.</p> <p>Event register for local presentation of the last 30 events.</p> <p>Easy selection of parameters and straight forward configuration of the whole annunciator unit.</p> <p>Sophisticated built-in self-supervision system for enhanced operational reliability.</p>
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<b>Introduction</b>	<p>The analogue annunciator unit type SACO 16A3 is a member of the substation secondary equipment system named SPACOM. The SPACOM system further includes protective relays and assemblies, remote control modules, on/off annunciator units and control data communicators for data acquisition and event reporting. All the SPACOM devices can be used as self-contained stand alone equipment. At the same time the various devices can be interconnected by means</p>	<p>of a serial communication to form protection, supervision, data acquisition, reporting and control systems as required by the application.</p> <p>The various devices of the SPACOM system can further be connected to a hierarchically higher level host system, e.g. a remote control system or an automation system, by means of the serial communication especially developed for that purpose.</p>
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<b>Areas of application</b>	<p>The units and modules of the SPACOM system have been developed and type tested for use under the most severe environmental conditions, where a maximum of functional reliability and immunity to interference is required. Further special attention has been paid to such system features as flexibility and the adaptability of the system to various tasks.</p>	<p>Typical areas of application with the above mentioned characteristics are:</p> <ul style="list-style-type: none"> <li>– electric power stations and distribution substations</li> <li>– industrial plants and process installations</li> <li>– marine installations and applications</li> </ul>
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<b>General system information</b>	<p>SACO 16A3 is a versatile 16-channel analogue annunciator unit with two adjustable high set-points and two adjustable low set-points per channel.</p> <p>Simply by programming the annunciator channels can be adapted to various transducer signal types such as current, voltage or resistance. Field contact signals are also accepted as channel input signals.</p> <p>The annunciator unit incorporates eight output auxiliary relays. Six output relays are reserved for group alarm purposes, one output relay is intended for the control of an external audible device and one output relay is controlled by the units internal self-supervision system.</p> <p>A hierarchically superior data acquisition system may obtain information, e.g. measured values, event register messages, set-points or other set parameters via the serial interface of the annunciator unit. Further, the settings may be altered via the serial interface. In cooperation with a master unit the analogue annunciator</p>	<p>may constitute part of a data acquisition and event reporting system.</p> <p>The versatile display features enable the annunciator unit to be used as a local measuring instrument. The measured values are presented in numerical form in the digital display or in the form of a curve or a bar graph in the matrix display. The measured value curve may be given five different time scales. The content of the event register may also be displayed.</p> <p>The selection of transducer type, scaling, grouping, set-point values and other parameters are carried out by means of the push-buttons and the display on the front panel or via the data bus and the serial interface.</p> <p>When the measured parameter exceeds or goes below the set-point value an indicator starts flashing on the front panel. At the same time the audible alarm output relay picks up and one or more rearm relays are programmed to respond. The event is further stored in the event register together with an attached real time stamp.</p>
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## Block diagram



Block diagram of the annunciator unit SACO 16A3.

## Mechanical construction

The annunciator unit is a modular device based on standardized plug-in Euroboards, 100 mm x 160 mm. The annunciator unit SACO 16A3 comprises the following modules:

- auxiliary supply module, type SPGU 240A1 or SPGU 48B2
- analogue signal input module, type SWAM 16A1
- microprocessor module, type SWPM 4A1
- display module, type SWDM 4A1
- input/output module, type SWOM 8A1 and 8A2

Further the annunciator unit comprises a connection module, type SWCM 10A1, which carries the PCB connectors on one side and the screw terminal strips to facilitate the external connections on the other side.

The screw terminals for the transducer input signals and for the remote resetting input signals are mounted on a detachable socket, which can be used as a separate connection base, e.g. when the annunciator unit is mounted in a pulpit or desk.

The case is made of profile aluminium and finished in beige. The mounting frame is of an aluminium alloy and has been stove finished with a semi-gloss, beige carbamide resin paint. The mounting frame is provided with a rubber gasket which tightens the joint between the case and the mounting panel to IP 54.

The cover of the case is moulded of a transparent, UV-stabilized polycarbonate. The cover is also provided with a gasket in order to ensure IP54 tightness between the cover and the mounting frame. The cover is locked with two finger screws which can be sealed.

The connection module holds a screw terminal strip for the auxiliary supply, the contact outputs and for the connection module for the SPA-bus. One screw terminal may accommodate one or two max.  $\varnothing 2.5 \text{ mm}^2$  conductors. No terminal lugs are needed.

The transducer signal inputs are provided with detachable terminal strips which allow the transducer wiring to be disconnected without opening any screw terminals. Each terminal accepts one multistrand conductor of max.  $\varnothing 1.5 \text{ mm}^2$ .

A connection diagram has been attached to one of the side walls of the annunciator case.

## Annunciator channel functions

### Transducer functions

The annunciator channel inputs accept current, voltage, resistance or contact-type transducer signals. The annunciator channel inputs are set to correspond with the various transducer types they are intended to be connected to simply by programming and by connecting the input signals to the appropriate terminals.

The channel input circuits are galvanically separated from the equipment earth and from the digital part of the electronics. However, the channels are galvanically interconnected. The arrangement described above enables earth-faults in the transducers and the field wiring to be easily supervised and detected.

Cable faults are supervised by means of the transducer signal which must not differ from the programmed measuring range in order to be accepted. Consequently cable discontinuity cannot be detected in transducer circuits ranging from zero. Cable faults are indicated on the digital display and simultaneously the tripping reflash functions are blocked.

The channel input signal range for current signals may be defined by programming from a series of standardized ranges, i.e. 0...5 mA, 1...5 mA, 0...20 mA and 4...20 mA. The built-in 270 ohm shunt resistor is connected across the channel input by means of a jumper. Alternatively an external shunt resistor may be used, in which case the input is preferably programmed for the input signal range 0...1 V. The auxiliary supply voltage for the signal transducers may be fed by the annunciator unit. The voltage level is 24 V dc and the total current drain must not exceed 320 mA.

The programmable channel input voltage signal ranges are 0...1 V, 0...5 V, 1...5 V, 0...10 V

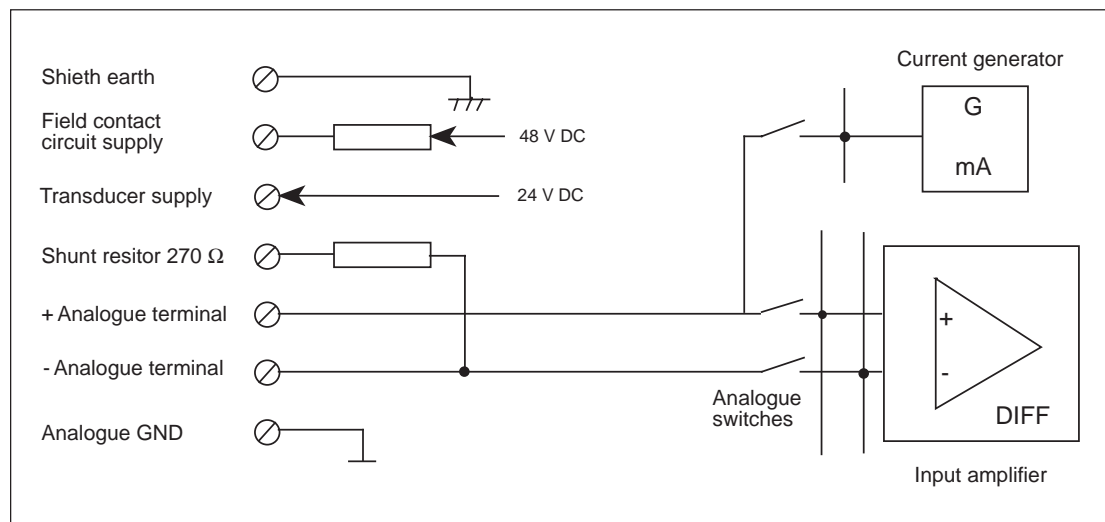
and 2...10 V and the transducer supply voltage may even in this case be taken from the annunciator unit itself.

When resistance input signals are to be used the input may be programmed for various transducers within the range (0...130  $\Omega$ )...(0...10 k $\Omega$ ). In addition to the potentiometric transducers the following sensor types may be used: Pt 100, Pt 250, Pt 1000, Ni 100, Ni 120, Ni 250 and Ni 1000. Further, a selectable resistance input for Pt or Ni sensors may be calibrated with potentiometers inside the unit.

The sensors may be connected to the channel input according to the three-wire principle or the two-wire principle. If the three-wire principle is used the conductor resistance is compensated for, provided that both conductors have the same resistance.

When the two-wire connection is used the conductor resistance can be compensated for by calculating the corresponding temperature change according to the Pt or Ni tables. This value can then be used for the compensation in the scaling tables on a per channel basis.

Normally open or normally closed field contacts may also be connected to the channel inputs. The +48 V dc field contact voltage is supplied by the annunciator unit. The unit measures the loop current in the field contact circuits over a built-in shunt resistor, which should be jumper connected to the channel input. Only one field contact should be connected to a +48 V terminal because the voltage over the concerned input drops to a few volts, if a second connected contact happens to be closed. The loop current for a closed field contact circuit is approx. 4 mA.

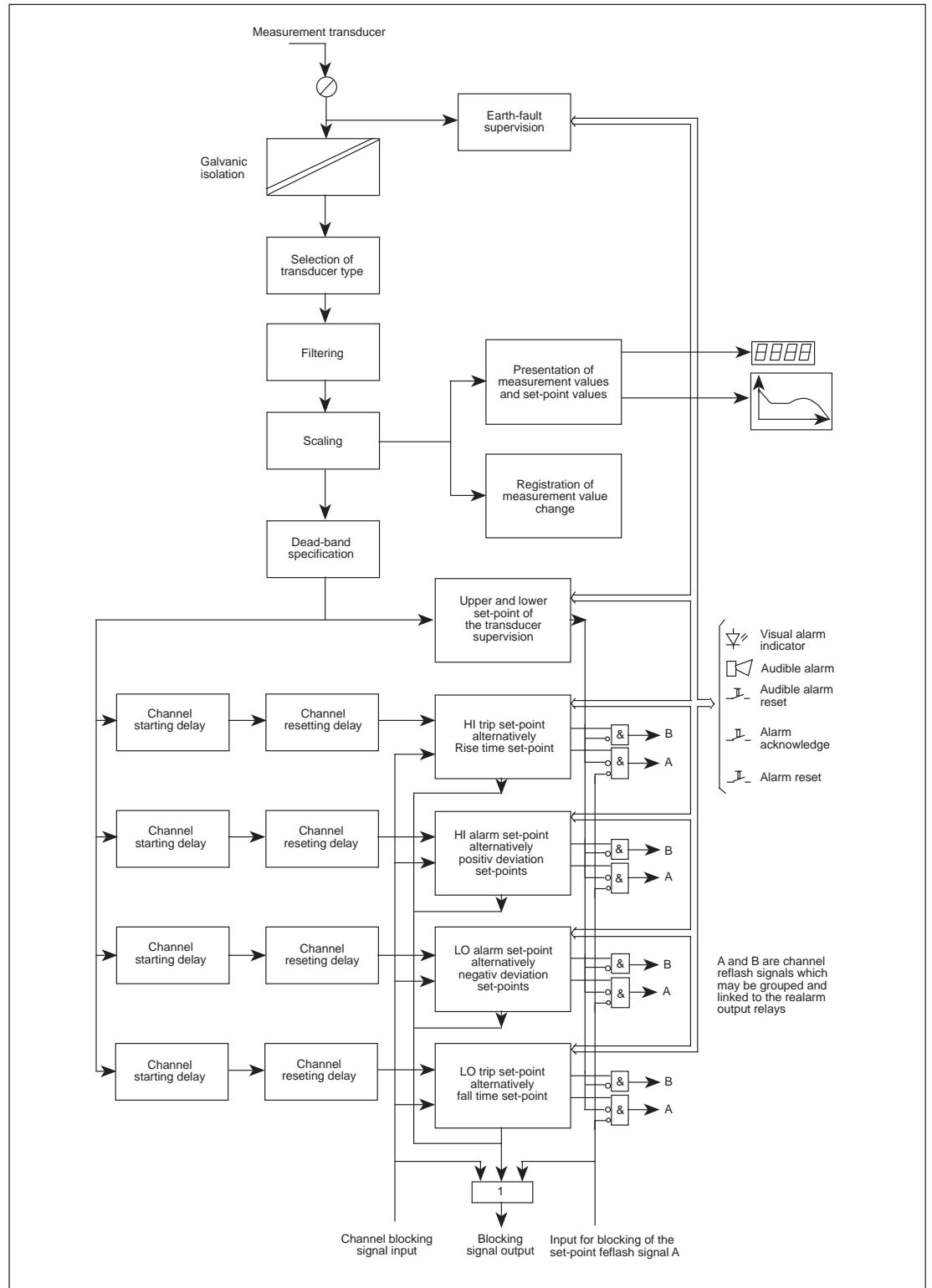


Principle diagram of a channel input.

Channel principle diagram

The various annunciator channel functions are illustrated in the following block diagram. The parameter settings are entered by means of the

push-buttons and the display on the front panel or via the serial interface.



Channel-function block diagram.

Various transducer types may be connected to the channel inputs without limitations following the instructions in the previous chapter.

The transducer circuits are galvanically separated from the equipment earth and from the electronics. However, between themselves the transducer

circuits are interconnected. This implies that the transducer circuits are floating and that they must not be earthed. The method of galvanic separation has been used in order to strengthen the immunity to interference of the channel input and to provide a means for employing earth-fault protection of the transducer circuits.

## Selection of transducer type

To the annunciator unit the channel type is communicated by means of a parameter on a per channel basis. The programming is executed through the INP.SIGN.SPEC parameter in the display or via the serial interface by using an S-parameter.

### S 47

- 0 = field contact input
- 1 = not specified
- 2 = not specified
- 3 = 0...5 mA
- 4 = 1...5 mA
- 5 = 0...20 mA
- 6 = 4...20 mA
- 7 = 0...1 V
- 8 = 0...5 V
- 9 = 1...5 V
- 10 = 0...10 V
- 11 = 2...10 V
- 12 = Pt 100, -20...230°C
- 13 = Pt 100, -20...600°C
- 14 = Pt 250, -20...230°C
- 15 = Pt 250, -20...600°C

- 16 = Pt 1000, -20...230°C
- 17 = Pt 1000, -20...600°C
- 18 = Adjustable Pt sensor, -20...600°C
- 19 = Ni 100, -13...130°C
- 20 = Ni 100, -13...250°C
- 21 = Ni 120, -45...250°C
- 22 = Ni 250, -13...130°C
- 23 = Ni 250, -13...250°C
- 24 = Ni 1000, -13...130°C
- 25 = Ni 1000, -13...250°C
- 26 = Adjustable Ni sensor, -13...250°C
- 27 = 0...200  $\Omega$
- 28 = 0...500  $\Omega$
- 29 = 0...2000  $\Omega$
- 30 = 0...1000  $\Omega$
- 31 = 0...2500  $\Omega$
- 32 = 0...10 k $\Omega$
- 33 = adjustable potentiometric input (0...130  $\Omega$ )...
- 34 = adjustable potentiometric input (0...640  $\Omega$ )...
- 35 = not specified

## Filtering

For signal filtering a so called median filter is used. This filter type shows no reaction to interference spikes but levels out directly on permanent measurement value changes. Three degrees of filtering may be selected. The time constant given determines the step response time of the input signal.

The step response time is programmed using the FILTER parameter on the display or via the serial port by defining the value of the parameter S45.

### S45

- 0 = 300 ms
- 1 = 1 s
- 2 = 5 s

For the purpose of providing a means for suppression of interference signals from ac networks, the frequency of the network may be keyed in. The frequency is a module-specific parameter and it may be entered with the push-buttons and the display using the MAIN FREQUENCY parameter. Via the serial part the S37 parameter is used.

### S37

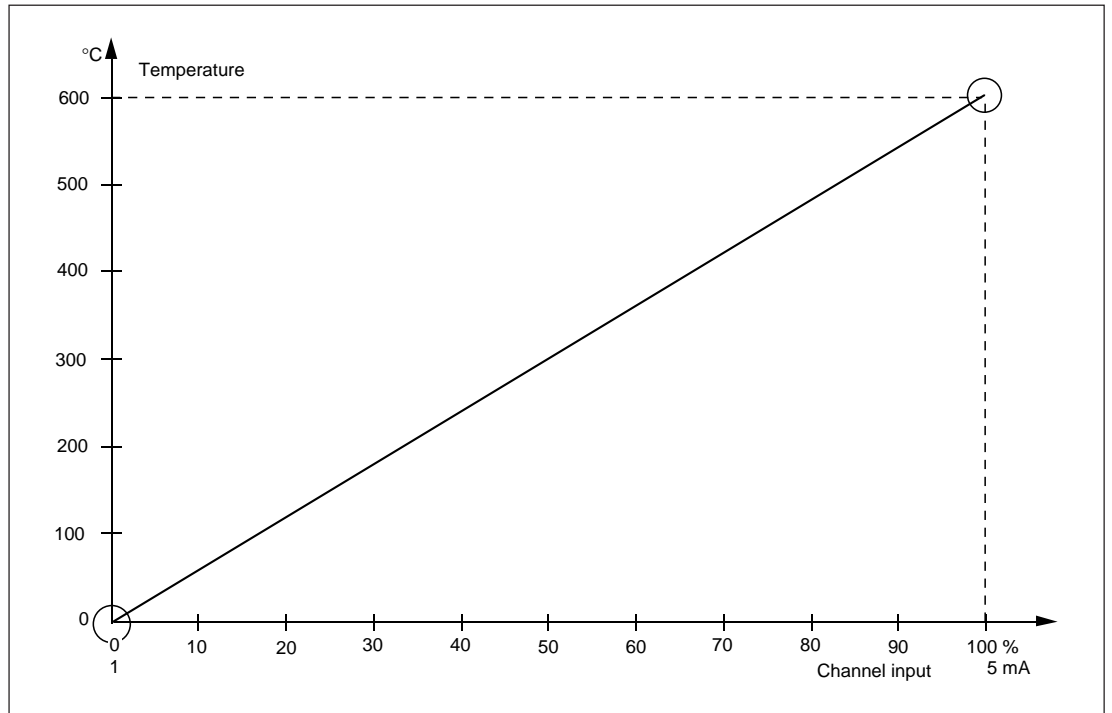
- 0 = 50 Hz
- 1 = 60 Hz



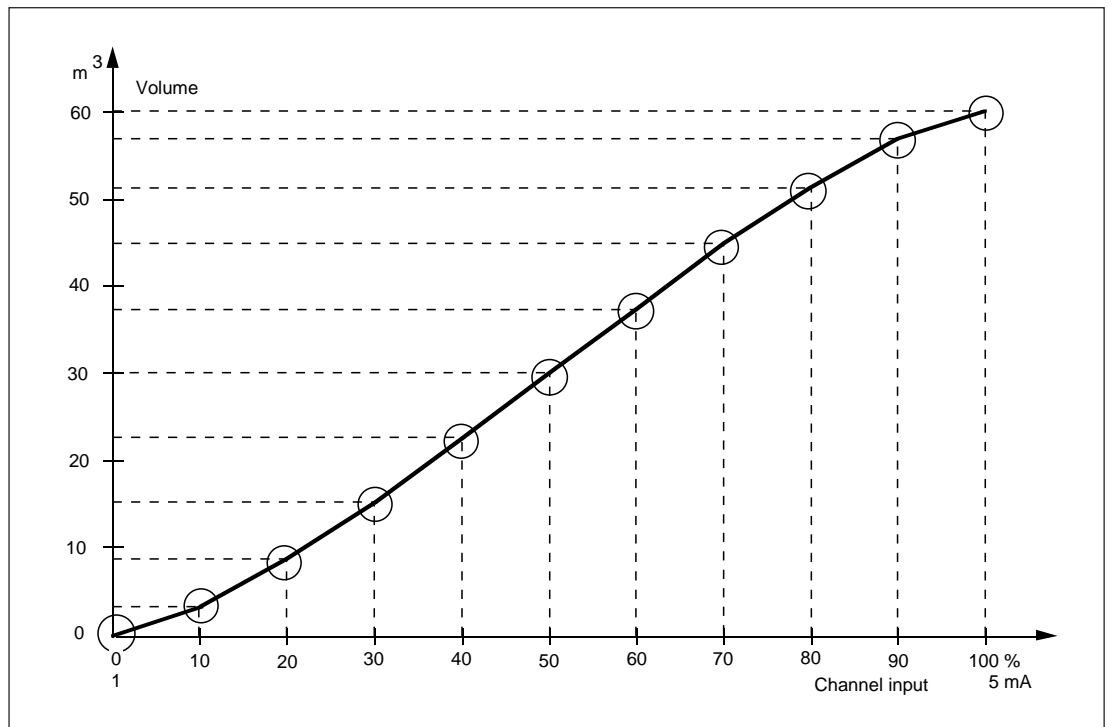
## Scaling

The annunciator channels are to be separately scaled. The scaling range is  $\pm 0.000\dots9999$ . The location of the decimal point is defined by the maximum value entered. The measuring signal may be given a linear or a non-linear scaling. A linear scaling is performed by giving a scale value for the minimum value of the measuring signal and a scale value for the maximum

value of the measuring signal. A non-linear scaling is performed by dividing the transducer signal range in ten different subranges each of which may be separately scaled. Consequently the scaling is defined by a broken line. This function may be used for compensating for the inaccuracy of the transducer or for linearizing a non-linear transducer.



Example of a linear scaling. (Exhaust gas measurement)



Example of a non-linear scaling. The figure illustrates the measurement of the volume of a liquid in a cylindrical tank in a horizontal position by measuring the surface level.

The scaling parameters are keyed in using the SCALING parameter in the matrix display or via the serial interface using S parameters. The following parameters may be used for scaling purposes.

S 33 +/-0.000...9999 = maximum value (100%)

S 34 +/-0.000...9999 = minimum value (0%)

S 35 +/-0.000...9999 = 10% of the maximum value

S 36 +/-0.000...9999 = 20% of the maximum value

S 37 +/-0.000...9999 = 30% of the maximum value

S 38 +/-0.000...9999 = 40% of the maximum value

S 39 +/-0.000...9999 = 50% of the maximum value

S 40 +/-0.000...9999 = 60% of the maximum value

S 41 +/-0.000...9999 = 70% of the maximum value

S 42 +/-0.000...9999 = 80% of the maximum value

S 43 +/-0.000...9999 = 90% of the maximum value

S 44 0 = linear scaling  
1 = non-linear scaling

Measured quantity

The measured quantity entered on a per channel basis may consist of max. 5 characters. It is entered with the MEASURED QTY parameter in the matrix display using the cursor control and character selection keys. The quantity is shown in the matrix display in combination with the set-point values. The measured quantity may also be entered via the serial interface using the S 49 parameter.

S 49 XXXXX = five characters

Transducer supervision

The measuring signal level of each transducer is constantly supervised. If the measured signal falls more than 4% below or goes more than 4% over the specified input signal range of a particular channel, the transducer or the transducer wiring are considered to be faulty. The transducer fault signal is immediately activated and all reflash signals from the channel are inhibited. The channel is also automatically disconnected from the average value measurement.

When necessary the measuring range may be narrower by definition than the measuring range of the concerned measuring transducer. The narrower range may be defined by means of the parameters INP. SUPERVISION HI LIMIT and INP. SUPERVISION LO LIMIT in the matrix display. When the supervision range is to be changed via the serial interface the S 51 and S 52 parameters are used.

A transducer fault is indicated as a normal alarm with the flashing indicator and an activation of the audible alarm and self-supervision output relays. On the digital display the letter F and the channel number are shown and the event is also stored in the local event register. The channel returns to normal when the transducer has operated within the specified range for a time not shorter than the longest selected channel starting or resetting time plus a basic time of 15 s.

S 51 +/-0.000...9999 = transducer supervision HI limit value

S 52 +/-0.000...9999 = transducer supervision LO limit value

Input oscillation

For each transducer input a permitted maximum number of events (set-point transitions) per minute may be defined. If the number is exceeded the storing of new events is stopped. The channel is forced into the active state and remains so until no set-point transitions have been recorded within two minutes. Thereafter the channel returns to normal operation.

The channel-specific oscillation supervision parameter INP.OSC.MONITOR is keyed in and displayed on the front panel or it may be set via the serial port with the S53 parameter.

S53  
0 = the oscillation supervision out of function  
1...255 = permitted number of events/min

The purpose of the channel input oscillation supervision is to prevent a transducer fault from overloading a higher level system by continuously transmitting event messages.

## Earth-fault

The analogue part of the annunciator, i.e. the channel input circuitry, is floating and by that means galvanically isolated from earth. This feature enables the annunciator unit to be provided with a built-in earth-fault supervision for the transducers, the transducer wiring and the channel inputs. The sensitivity of the earth-fault supervision is 5...10 k $\Omega$ . When an earth-fault is detected the EF letters appear in the digital display. The audible alarm output and

the self-supervision output are activated. The indication persists until the earth-fault situation is over. The earth-fault supervision may be set out of function by removing the S1 jumper on the mother PC board. The jumper is made accessible by removing the front panel and by drawing the supply module to the left.

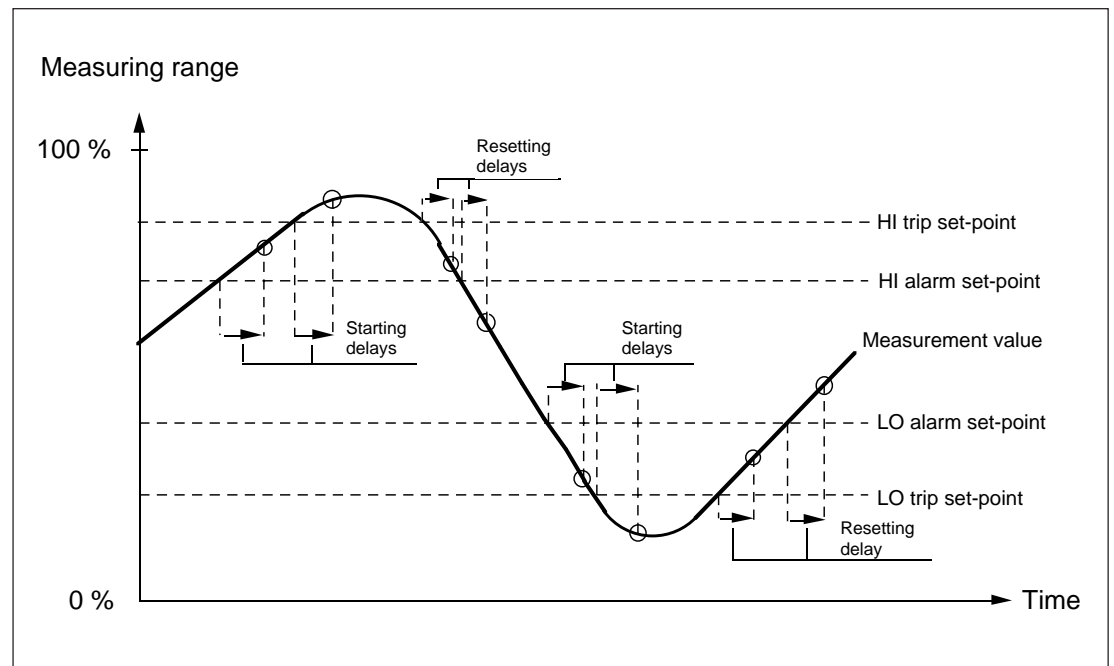
**WARNING!** Switch off the auxiliary supply before the auxiliary power module is withdrawn.

## Set-points

Each channel may be given up to four set-points according to two principles. The first principle includes two HI set-points and two LO set-points. The second principle includes one HI set-point and one LO set-point and further one rise time and one fall time set-point. When the input signal exceeds or goes below a set-point and after the channel starting delay has timed out, an alarm indication is obtained according to the selected sequence scheme. An audible

alarm is obtained if selected and rearmings are provided if being configured. The indications and the output relays are reset according to the selected sequence scheme, after that the measured value has returned to normal the channel resetting time has elapsed and the required acknowledgements have been performed. All set-point value transitions and resettings are recorded with time stamps and stacked in the internal event register.

## Alternative 1. Two HI and two LO set-points



Example showing set-point value transitions. The arrows indicate activation and deactivation of the set-point value function after that the channel starting and resetting times have elapsed. Also note the deadband function.

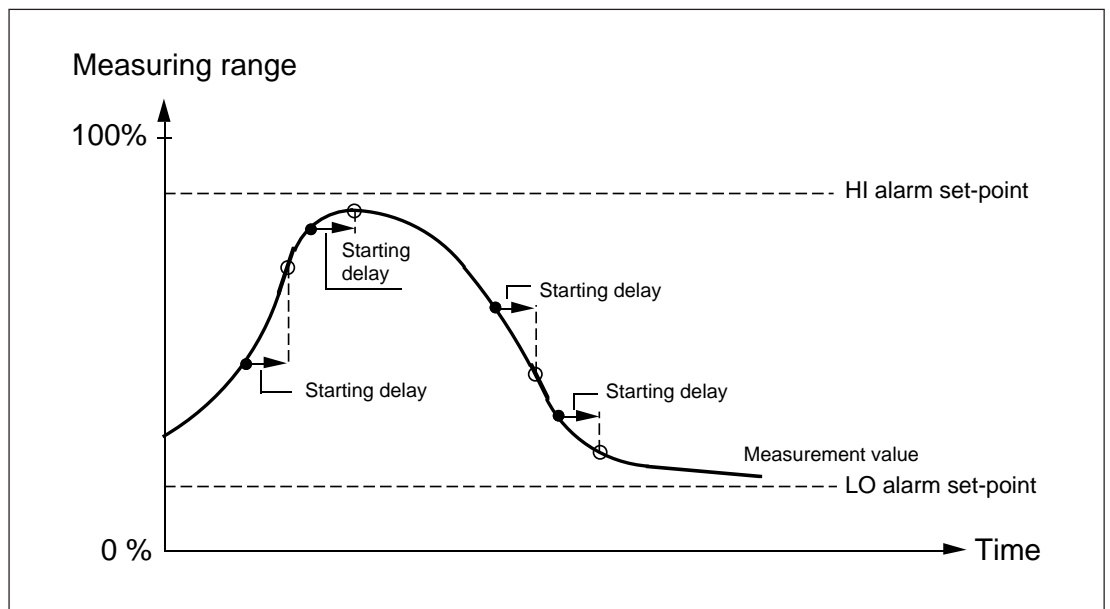
The set-point values are set with the push-buttons and the matrix display using the HI TRIP POINT, HI ALARM POINT, LO

ALARM POINT and LO TRIP POINT parameters. Over the serial port the setting of the set-points is performed using the following parameters:

- S1 +/-0.000...9999 = HI alarm set-point
- S2 +/-0.000...9999 = HI trip set-point
- S3 +/-0.000...9999 = LO alarm set-point
- S4 +/-0.000...9999 = LO trip set-point

Channel starting delay	The activation of the channel may be delayed by 0.5 s to 255 s from transition of a set-point value. Using the matrix display this is performed with the RESP. TIME parameter of the sub-menu of the set-point setting. When the programming is done via the serial interface the S 5, S 6, S 7 and S 8 parameters are used.	<p>NB The input delay of the trip set-point value must exceed or equal the delay of the alarm set-point value.</p> <p>S 5 0...255 = starting time in seconds of HI alarm set-point</p> <p>S 6 0...255 = starting time or rise time limit in seconds of HI trip set-point</p> <p>S 7 0...255 = starting time in seconds of LO alarm set-point</p> <p>S 8 0...255 = starting time or fall time limit in seconds of LO trip set-point</p>
<hr/>		
Channel resetting delay	The channel resetting after a transition of a set-point value may be delayed by 0.5 to 240 s. Using the matrix display the resetting time is programmed with the RESET TIME parameter. When the programming is done via the serial interface the S 9, S 10, S 11 and S 12 parameters are used.	<p>N.B. The resetting delay of a trip set-point value must exceed or equal the resetting time of an alarm set-point value.</p> <p>S 9 0...255 = resetting time in seconds of HI alarm set-point</p> <p>S 10 0...255 = resetting time in seconds of HI trip set-point</p> <p>S 11 0...255 = resetting time in seconds of LO alarm set-point</p> <p>S 12 0...255 = resetting time in seconds of LO trip set-point</p>
<hr/>		
Deadband	Each channel may be given an individual deadband value entered in per mille of the measuring range. Transition of the set-point value activates the channel but for the resetting to occur the input value must go below or exceed the set-point value by a value determined by the deadband setting. This to prevent "pumping" of a channel to block the serial communication channel.	<p>The deadband value is entered via the matrix display with the DEADBAND parameter and via the serial interface with the S 46 parameter.</p> <p>S 46 0...99 = deadband value in per mille of the measuring range</p>

Alternative 2.  
 One HI and one LO  
 set-point and one  
 rise time and one  
 fall time set-point



Example showing set-point value transitions. The arrows indicate activation and deactivation of the set-point value function after that the channel starting and resetting times have elapsed. Also note the effect of the deadband setting.

In this case two rate of change values may constitute limit value criteria in a addition to the two ordinary set-points of the channel. The rise and fall rates, are in this case determined as the ratio of the input value change to the channel input signal range expressed in per cent per minute. If the rise or fall rate exceeds the set limit value for a period of time longer than the channel starting time the limit value is activated. Correspondingly the limit value is reset if the rise or fall rate goes below the set limit value for a period of time longer than the channel starting time. The rise and fall rate functions supersede the HI and LO Trip set-points of the earlier Alternative 1.

If the rise and fall rate limits are given percentage values by programming, the channel automatically will function according to Alternative 2. With the push-buttons and the matrix display the percentage values are entered using the RISE RATE HIGH and FALL RATE HIGH parameters. Via the serial port the percentage values are given using the parameters S 21 and S 22.

- S 21 0 = rise rate alarm out of operation  
 1...100 = signal value increase in per cent of the measuring range of the input/minute
- S 22 0 = fall rate alarm out of function  
 1...100 = signal value decrease in per cent of the measuring range of the input/minute

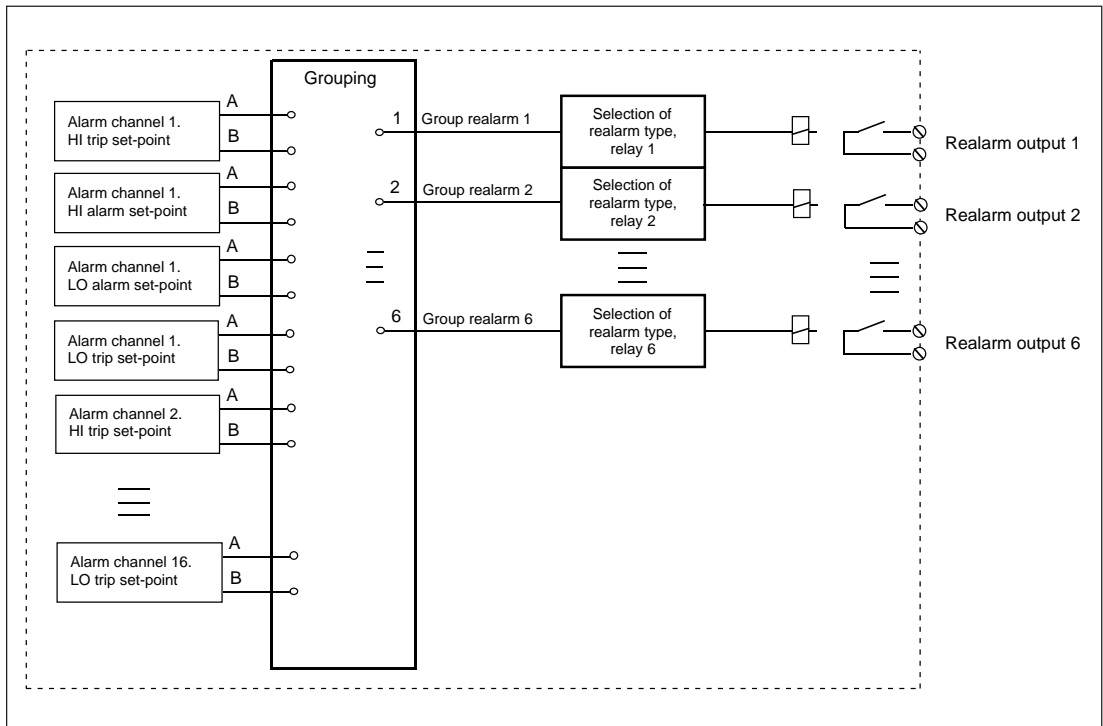
## Grouping of reflash outputs

Each transition of a set-point value may initiate operation of two free-selectable group alarm relays. The annunciator unit contains six group alarm output relays. To facilitate the configuration of the control signals for the output relays each set-point value is related to two reflash outputs, A and B.

Via the matrix display the configuration of group alarms is performed on a per set-point value basis using the parameters RFLA TORLY and RFL B TO RLY of the submenu of the set-point value setting routine. Via the serial interface the grouping information is entered using the parameters S 13...S 20.

- S 13 0...6 = HI alarm set-point, output A
- S 14 0...6 = HI alarm set-point, output B
- S 15 0...6 = HI trip set-point or rise time limit, output A
- S 16 0...6 = HI trip set-point or rise time limit, output B
- S 17 0...6 = LO alarm set-point, output A
- S 18 0...6 = LO alarm set-point, output B
- S 19 0...6 = LO trip set-point or fall time limit, output A
- S 20 0...6 = LO trip set-point or fall time limit, output B

The parameter value 0 denotes that the reflash output has not been connected to any output relay. The parameter values 1...6 indicate to which output relay the set-point has been connected.



Principle of the configuration of group reflash alarms.

Interlockings

The annunciator unit includes four blocking lines which, by means of a flat cable, may be extended over to other SACO units as well.

Each set-point transition may be linked to activate one or two blocking lines. An activation is obtained when one of the four set-point values of a channel has been exceeded or gone below. An activated blocking line may be used for blocking other channels or for blocking of the reflash outputs A only of other channels.

The blocking instructions may be entered via the matrix display using the INTERLOCKINGS parameter and in the submenu the following functions may be selected: 1: GROUP\_FUNCT.\_ and 2:GROUP\_FUNCT.\_.

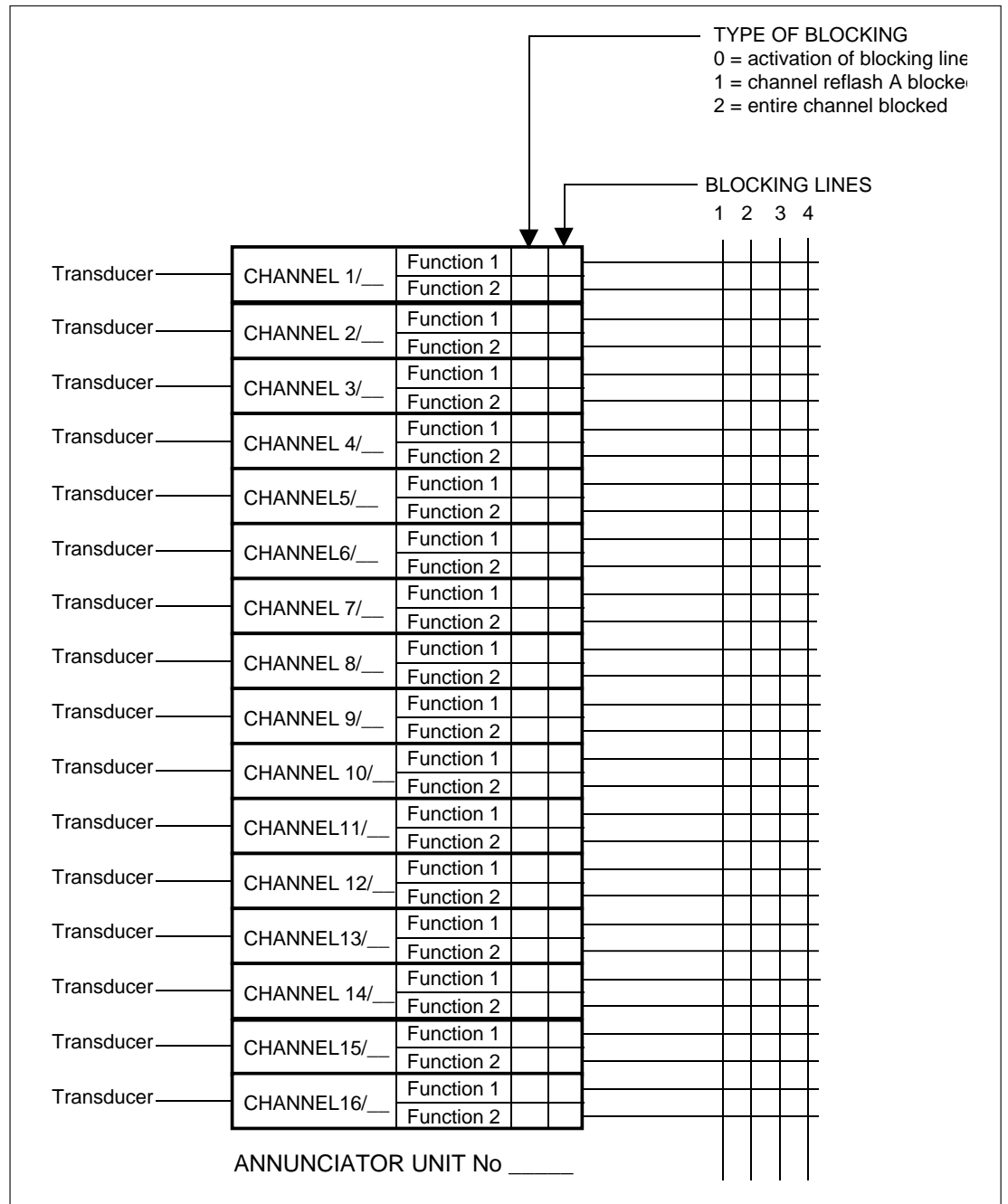
Via the serial interface the instructions may be entered using the parameters S 28...S 31.

Blocking function 1

- S 28 0 = activation of blocking line  
1 = channel reflash output A blocked  
2 = entire channel blocked
- S 29 0 = not connected to a blocking line  
1...4 = connected to a blocking line

Blocking function 2

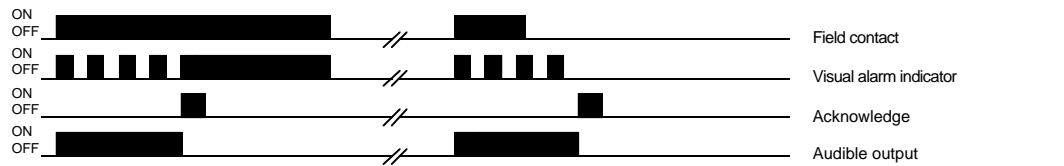
- S 30 0 = activation of blocking line  
1 = channel reflash output A blocked  
2 = entire channel blocked
- S 31 0 = not connected to a blocking line  
1...4 = connected to a blocking line



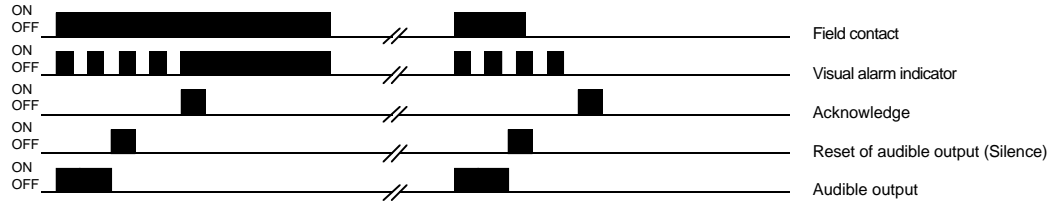
Principle figure of blocking functions.

Registration of alteration of measured value	When the annunciator unit is used as an I/O unit of a large system, a spontaneous message initiated by an alteration of the input value may be obtained in the following way. An input value alteration of a given size is registered and stored in the event register, from which it is automatically sent to the reporting level of the SPACOM system. The predefined value of alteration of the measured is given as scaled value and counted from the previous registration of an alteration.	The value of the alteration is entered via the matrix display with the DELTA VALUE parameter or via the serial interface with the S 32 parameter.  S 32 0.000...9999 = input value alteration as a scaled quantity  If no registration is needed the value 9999 may be entered.
Calibration	On delivery the annunciator units are factory calibrated to a channel accuracy better than 0.5 %. The most convenient way of changing the cali-	bration is to change the scaling. In this way inaccurate transducers may be calibrated to provide a correct measurement.
Channel text	Each channel may be given a 10 character channel text. This may be entered via the matrix display using the CHANNEL TEXT-	parameter or via the serial interface using the S 50 parameter:  S 50 XXXXXXXXXXXX = 10 characters as per channel
Reading of measured value	The value measured by a particular channel may be presented as a scaled value in the digital display or in the matrix display in either bar graph or curve form. The measured value can also be read via the serial interface using the input parameters I1 and I2:	I1 0 = field contact open 1 = field contact closed +/- 0.000...9999 = measured value in scaled units  I2 0000...1023 = unscaled measured value in binary form.
<b>Sequence patterns for the alarm and tripping functions</b>	The annunciator unit may be given one out of five standardized flashing and resetting sequence patterns by programming. The most suitable sequence pattern is selected. Via the matrix display the sequence pattern to be used is selected using the ALARM SEQUENCE parameter and via the serial interface using the parameter S 24.	The alarm sequence patterns may be supplemented on a per channel basis in three different ways by programming. Through the matrix display the programming is performed using the ALARM SEQUENCE parameter and via the serial interface using the S 48 parameter.
Annunciator channel sequences	S 24 0 = ISA A, automatic channel reset 1 = ISA A-1, automatic channel reset, manual audible reset 2 = ISA M-1, manual channel reset, manual audible reset 3 = ISA R-1, manual channel reset, visual ringback, manual audible reset 4 = DIN 19235, visual ringback, manual audible reset	S 48 0 = visual indication according to the selected sequence pattern of the annunciator unit 1 = visual indication according to the selected sequence pattern of the annunciator unit but including audible ringback on return to normal. Applicable only in combination with the ISA R-1 and DIN 19235 sequence patterns. 2 = indication with steady light on set-point transition. The indication disappears automatically on return to normal. No audible alarm.
	The above sequence patterns are shared by all the 16 channels of the annunciator unit. This is why they are referred to channel 0, which has been reserved for all the module-specific parameters.	The acknowledge and reset measures are carried out in accordance with the procedure defined by the selected sequence scheme.

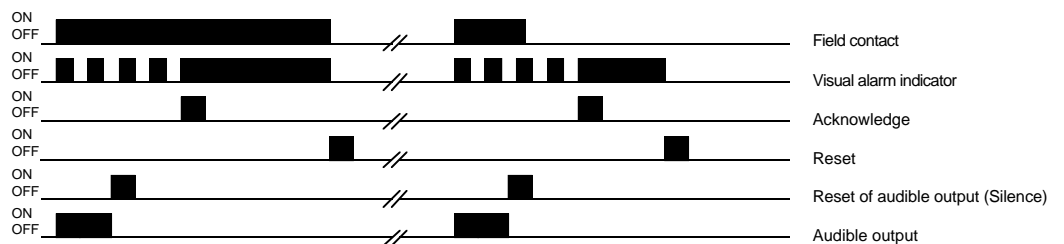




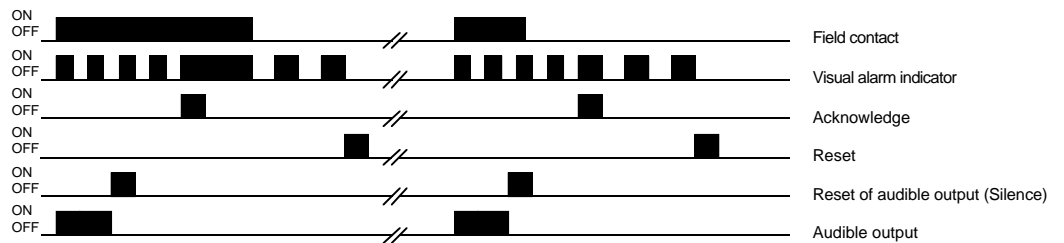
Automatic reset  
ISA A



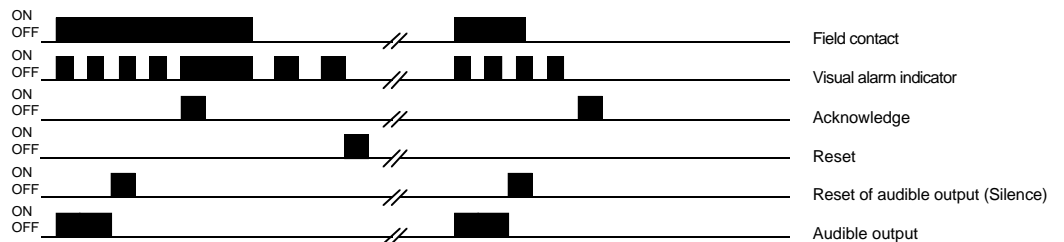
Automatic reset, separate reset of audible output  
ISA A-1



Manual reset, separate reset of audible output  
ISA M-1



Manual reset, visual ringback and separate reset of audible output  
ISA R-1

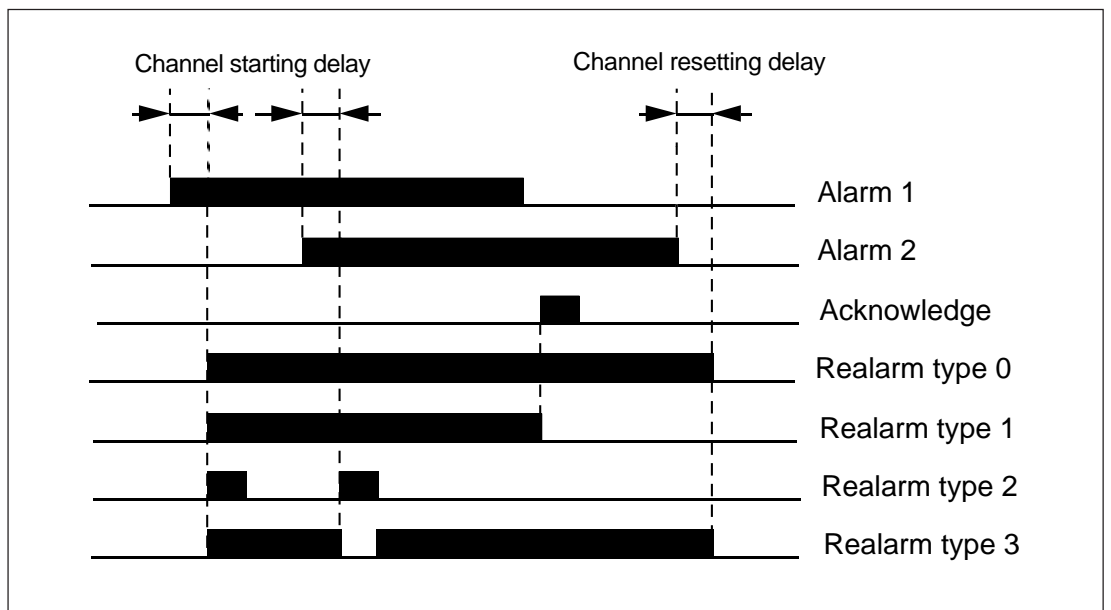


Manual reset, visual ringback if acknowledge is done before the alarm input returns to normal state, separate reset of audible output  
DIN 19235

Selectable channel sequence patterns.

Trip sequences	The sequence types for the trippings are the same as those for the alarms, except for the flash frequency of the visual indicator. The flash	frequency indicating transition of a trip set-point is twice that of the frequency indicating a transition of an alarm set-point.
First-out alarm and first-out trip	The digital display always displays the first-out alarm or the first-out tripping after the last reset. The two right-most digits of the display indicate the channel number and the two left-most digits indicate the type of alarm or tripping.	The following types are indicated: u = LO alarm level has been gone below n = HI alarm level has been exceeded u u = LO trip level has been gone below n n = HI trip level has been exceeded
Local/remote control	The annunciator unit has been provided with two control inputs, marked LOCAL and REMOTE. The control inputs, which are to be controlled with separate normally open contacts, are energized by the same 48 V dc voltage as the rest of the field contact inputs of the annunciator unit. When the annunciator unit is used in an unmanned station, the audible alarm output may be set out of function by activating the REMOTE input. On the other hand, during local maintenance work the group realarm	signals for the network control centre may be blocked by activating the LOCAL input. When neither control input has been activated both audible alarm and group realarms are obtained. The LOCAL or REMOTE mode may also be selected via the serial interface by using the parameter V1.  V1 1 = local/remote mode 2 = local mode 3 = remote mode
<b>Real time clock</b>	The annunciator unit includes a real time clock with battery back-up. The clock circuit provides time marks comprising year, month, day, hour,	minute and second. The clock time is shown in the matrix display when the basic display has been selected.
Clock synchronization	When the annunciator unit constitutes part of a SPACOM system the clock will be synchronized automatically once every second by means of a synchronizing pulse via the SPA bus. The clock may also be synchronized via the synchronizing input on the terminal block using the minute synchronizing principle. The clock is	moved back or forth to the nearest minute at the moment the SYNC. input is energized with the +48 V dc voltage provided by the annunciator unit itself. The actual synchronization takes place at the moment the control input circuit is closed. The minimum required control pulse length is 100 ms.
Time setting	The basic time setting is performed through the matrix display and a submenu of the TIME SETTING parameter. Years, months and days are set with the DATE parameter. With the	TIME parameter the hours, minutes and seconds are set. Via the serial interface the time setting may be carried out using the T parameter.

<b>Contact outputs</b>	The annunciator unit includes eight output relays. One serves as the audible alarm output relay, one as the alarm output relay of the self-	supervision system of the unit and six of the output relays serve as realarm output relays and may be grouped as required by the application.
Groupable output relays	Each set-point value transition may be programmed to operate two output relays. To facilitate the programming each set-point is provided with two reflash outputs, A and B. The reflash output A only or both reflash outputs may be blocked. The reflash outputs are con-	nected to the realarm output relays over a software connection matrix, with the set-point value transitions on the input side and the realarm output relays on the output side, also see section "Grouping of reflash outputs".
Setting of realarm output relay function mode	Each realarm output relay may separately be programmed for one out of four selectable functional modes. As the functions are related to output relays, which are common to all the	alarm channels, these parameters are programmed on a per unit basis and for the programming channel 0 is used.



Principle diagram illustrating the realarm output relay function modes. Alarms 1 and 2 assumed to be grouped to the same output relay.

Through the matrix display the output relay programming may be performed using a sub-menu of the REFL.RELAY MODE parameter. Via the serial interface the programming may be done using the following parameter:

The realarm output relays 2...6 are programmed in the same way by using the parameters S2...S6.

**Realarm relay 1**

- S 1 0 = field signal following realarm
- 1 = memory controlled realarm
- 2 = pulse shaped realarm 0.3...255.0 s
- 3 = field signal following realarm, which is interrupted for 0.3...255.0 s each time a new alarm signal joins an already alert realarm signal

Pulse length

When the pulse shaped rearm has been selected the pulse length may be defined through the matrix display using the PULSE parameter or via

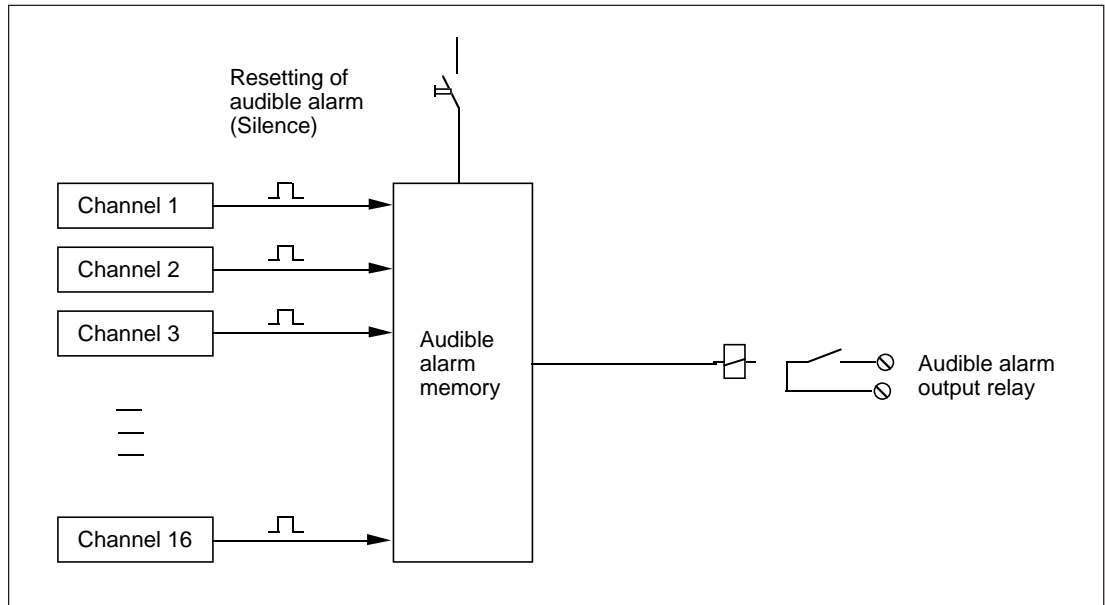
the serial interface using the parameter S 23.

S 23 0...255 = pulse length in seconds

Audible alarm output relay

The audible alarm output relay is operated as soon as a set-point value of any of the 16 channels has been crossed. Further each channel may be separately programmed to initiate an audible

alarm on return to normal of the alarm channel. When a channel has been programmed for the input signal following mode of indication, the audible alarm output relay is not operated.



Principle diagram of the audible alarm function.

Self-supervision system output relay

The annunciator unit is provided with a built-in, sophisticated self-supervision system which operates a normally energized output relay. On detection of an internal fault or upon loss of

auxiliary supply the alarm output relay drops off and the normally (=healthy and energized unit) open alarm contact closes.

## Average value measurement

The annunciator unit incorporates an average value measurement function which is connected to channel 0. The average value function is a program which calculates the scaled arithmetic average value of all the channels that have been incorporated in the measurement.

A common application of the average value

measuring function is the supervision of the exhaust gas temperatures of a diesel engine. The average value then provides an indication of the loading condition of the engine and on a per cylinder basis one can define how high the temperature deviation from the average value is allowed to grow during various engine loading conditions

## Average value set-point

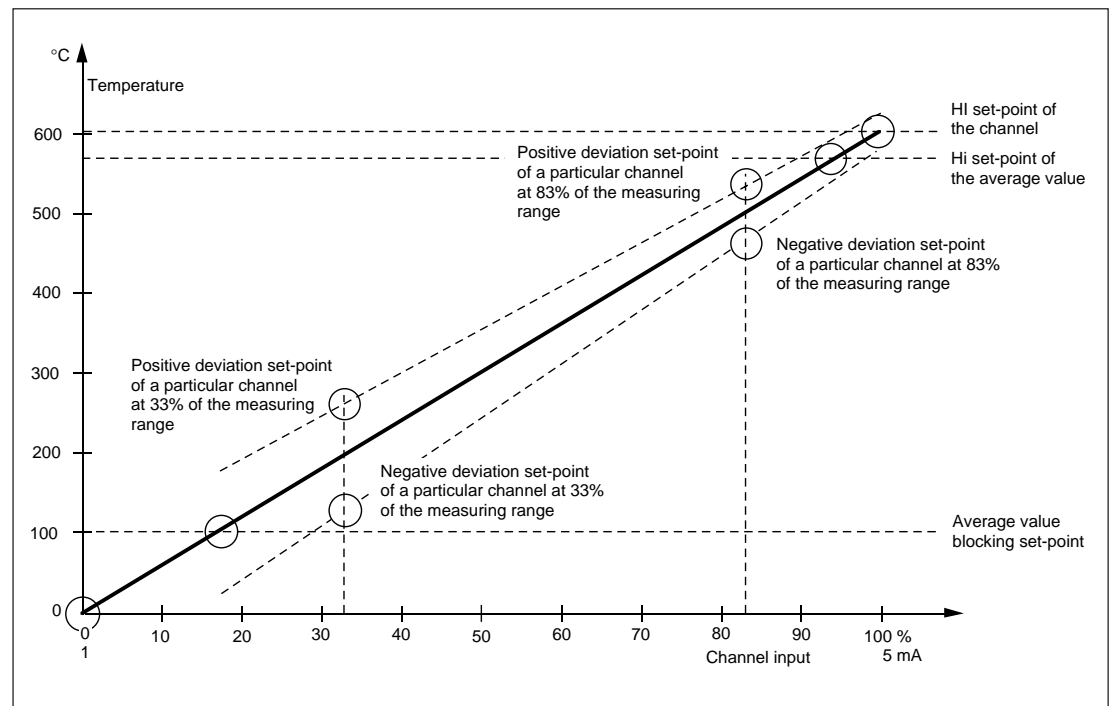
Two set-points may be associated to the average value. One of the set-points is an upper set-point, which may be connected to one or two group rearm outputs. The other set-point is a lower set-point, the signal of which is used to block deviation alarms from channels connected to the average value function.

With the aid of the matrix display the setting value of the upper set-point is keyed in using the

AV. TRIP POINT parameter and the lower set-point using the AV. LOCK POINT parameter. Via the serial interface the setting is performed using the parameters S 26 and S 27.

S 26 +/- 0.000...9999 = upper set-point value of average value

S 27 +/- 0.000...9999 = lower set-point value of average value



Average value function in association with exhaust gas temperature supervision of diesel engine.

<p>Grouping of average value set-points</p>	<p>Both set-points may be connected to the re-alarm outputs via a submenu of the set-point value setting menu if performed with the aid of the matrix display. The concerned parameters are named RFLA TORLY and RFLB TORLY. If the programming is performed via the serial interface the parameters S 28...S 31 are to be used.</p> <p>Upper set-point, reflash A S 28 0 = not connected 1...6 = group realarm output 1...6</p>	<p>Upper set-point, reflash B S 29 0 = not connected 1...6 = group realarm output 1...6</p> <p>Blocking set-point, reflash A S 30 0 = not connected 1...6 = group realarm output 1...6</p> <p>Blocking set-point, reflash B S 31 0 = not connected 1...6 = group realarm output 1...6</p>
<p>Delay of average value set-point alarm</p>	<p>Both set-points may be given response and resetting delays. With the aid of the matrix display the delay times are set by means of the submenu parameters RESP. TIME and RESET TIME. Via the serial interface the setting is performed using the parameters S 32...S 35.</p>	<p>S 32 0...255 = response time in seconds of upper set-point S 33 0...255 = resetting time in seconds of upper set-point S 34 0...255 = response time in seconds of blocking set-point S 35 0...255 = resetting time in seconds of blocking set-point</p>
<p>External reference value</p>	<p>Sometimes there may be a need for using an external signal as a reference of the loading situation of the engine. Then one channel may be dedicated for the purpose of performing the average value function. The input signal connected to this channel then corresponds to e.g. the loading situation of the engine. This channel must then be given the setting values of the average value channel. The external reference channel may also be used for obtaining a difference supervision of two channels.</p>	<p>With the aid of the matrix display the channel is selected by means of the parameter EXT.REF. CHANNEL. and via the serial interface using the parameter S 36.</p> <p>S 36 0 = no channel selected, normal average value function 1...16 = one of the channels 1...16 used as a reference</p>
<p>Connection of channels to the average value calculation</p>	<p>The channels are to be connected to the average value calculation one by one. By the support of the matrix display the channels are connected to the average value calculation by using the REF.VALUE DEVS menu and then the submenu INCLUDED?. Via the serial interface the</p>	<p>same programming is performed using the channel-specific S 23 parameter.</p> <p>S 23 0 = channel not connected to average value calculation 1 = channel connected to average value calculation</p>

Setting of channel-specific deviation set-points	<p>Any channel connected to the average value calculation may be given a upper set-point which equals the HI trip set-point of an ordinary channel. Further the channel may be provided with a HI and a LO deviation set-point in relation to the average value. As the permitted deviation from the average value usually is higher at lower engine loading levels, the deviation set-point may be given separately for low loads (33%) and heavy loads (83%). The permitted deviation will then be calculated by linear interpolation between the given set-points. When the engine loading exceeds 83% the deviation set-points are extrapolated. When the average value function is used for the temperature supervision of the exhaust gases of an engine and the scale range selected is 0...600°C, then 33% corresponds to the scale value 200°C and 83% to the scale value 500°C.</p> <p>By support of the matrix display the deviation set-point values may be entered in a submenu of the main menu REF.VALUE DEVS using the parameters +DEV 33%, -DEV 33%, +DEV 83%</p>	<p>and -DEV 83%. Via the serial interface the deviation set-points are entered using the parameters S 24...S 27.</p> <p>S 24 +/-0.000...9999 = positive deviation at 83% of measuring range</p> <p>S 25 +/-0.000...9999 = positive deviation at 33% of measuring range</p> <p>S 26 +/-0.000...9999 = negative deviation at 83% of measuring range</p> <p>S 27 +/-0.000...9999 = negative deviation at 33% of measuring range</p> <p>As previously mentioned the setting of the HI set-point value is performed by the support of the matrix display using the HI TRIP POINT parameter. When set via the serial interface the corresponding parameter is named S 2.</p> <p>S 2 +/-0.000...9999 = HI trip set-point</p>
Grouping of channel-specific set-point values	<p>Crossing a deviation set-point value activates the same functions as exceeding the HI alarm set-point. Thus, crossing a deviation set-point value also causes a group realarm output relay to pick up, if connected to the HI alarm set-point. The response times of the deviation set-points, too, equal those of the HI set-point values.</p> <p>By support of the matrix display the grouping is performed using the HI ALARM POINT submenu. The grouping parameters are named</p>	<p>RFL A TO RLY and RFL B TO RLY. Via the serial interface the grouping is carried out using the parameters S 15 and S 16.</p> <p>S 15 0 = reflash A not connected 1...6 = reflash A connected to realarm output 1...6</p> <p>S 16 0 = reflash B not connected 1...6 = reflash B connected to realarm output 1...6</p>
Setting of response and reset times	<p>The input response times and the channel resetting times are also set by means of a submenu of the alarm set-point value setting HI TRIP POINT. The concerned parameters are named RESP. TIME and RESET TIME. When carrying out the setting via the serial interface the corresponding parameters are named S 6 and S 10:</p>	<p>S 6 0...255 = input response time of the HI alarm set-point and deviation set-point expressed in seconds</p> <p>S 10 0...255 = reset time of the HI alarm set-point and deviation set-point expressed in seconds</p>

## Serial communication

The annunciator unit is provided with a multi-drop type serial interface. Via the serial interface the annunciator unit may also be connected to other higher level systems provided that the SPA-bus protocol is implemented to the concerned system. The annunciator unit SACO

16A3 may be used for both data logging and event handling when connected to a higher level system. Connection to a LON-bus system is also possible using the LON/SPA Gateway, SPA-ZC 100.

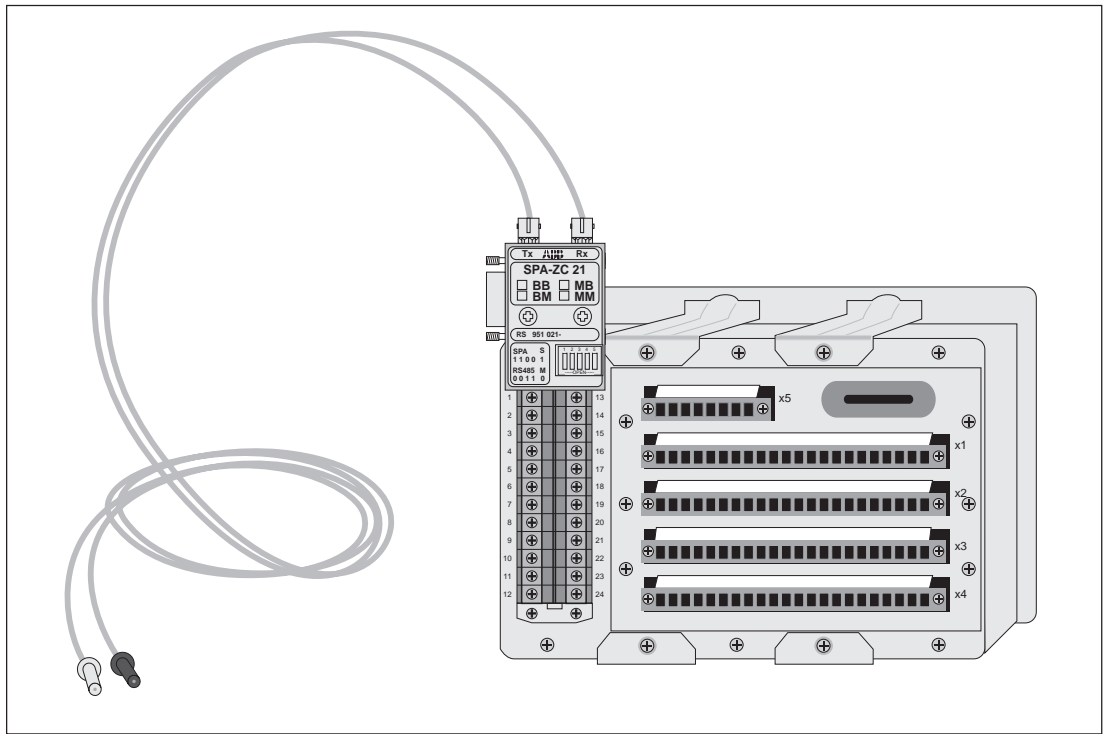
## Bus connection modules

The SPA-bus is preferably utilized by fibre-optical connection due to the high interference surrounding where the units are used. Electrical connection for the SPA-Bus is also possible but not recommended. For the connection of the serial bus to the annunciator unit a bus connection module of the SPA-ZC...-series is needed. The bus connection modules are attached to the back plate of the annunciator unit by means of the enclosed fastening sleeves. The following types of bus connection modules are available:

cables may be of the plastic core type or of the glass fibre type. The cable type for which the bus connection module is intended is indicated by the last two letters of the type designation. The letter B stands for a plastic core cable and the letter M for a glass fibre cable. The first of the two letters refers to the outgoing cable and the last letter to the incoming cable. For plastic core cables the maximum data transfer distance is approximately 30 m and for glass fibre cables at the moment approximately 2000 m.

The SPA-ZC21 is used in combination with a fibre-optic bus. The fibre-optic bus forms a loop and accordingly the bus connection modules are provided with one input and one output connector for the fibre-optic cables. The fibre-optic

SPA-ZC 17 may also be used. SPA-ZC 17 is the same as SPA-ZC 21 but with separate power supply, which enables the rest of the SPA-Bus to stay intact in an event of power failure in one SPACOM unit.



Rear view of the annunciator unit with a bus connection module attached to the terminals.

## Communication protocol

The protocol of the SPA-bus is of the ASCII type and it has been described in detail in the product description 34 SPACOM 2EN1.

The LON TALK protocol is described in the document LON Bus - LON WORKS Network in Protection and Control System; 1MRS 750035-MTD EN



Transferred data

- Via the serial interface the following information may be read from the annunciator unit:
- event register data with attached time labels.
- The events may be set-point value transitions or predefined measurement value changes
- measurement values
  - setting values and parameter settings
  - set-point activations

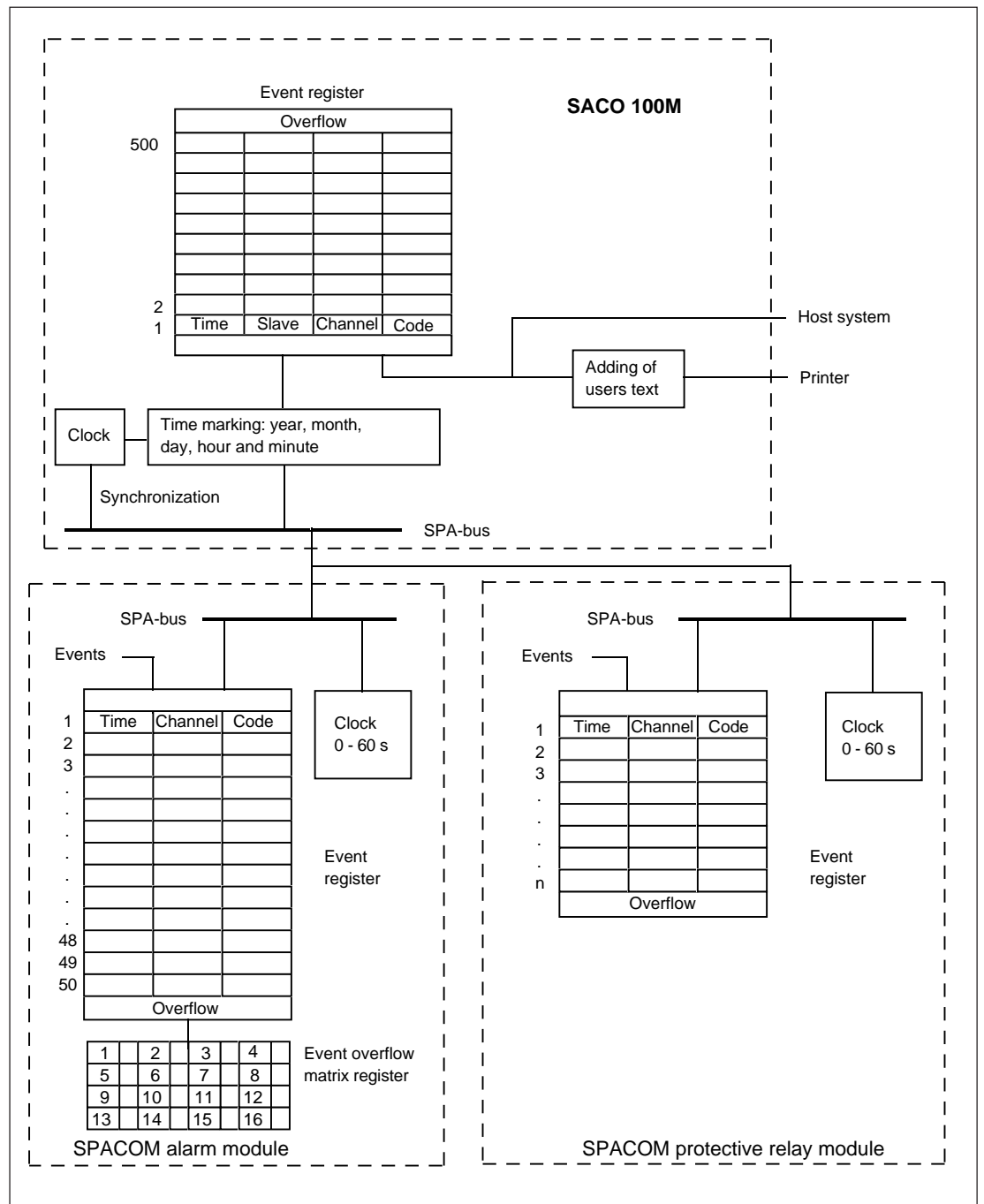
The following information may be transmitted to the annunciator unit:

- setting values and parameter values
- control commands to the output relays
- clock synchronizing signals

Event register for the SPACOM reporting system

A separate register for 30 events facilitates the connection of the annunciator unit to the SPACOM reporting system. The events are stored including event code, time marking in seconds and channel number. The contents of the event register is cyclically read by the repor-

ting unit. The events are then, on the reporting level, coordinated with events from the other annunciator units and placed in chronological order on the basis of the time markings. After this the events may be printed out on a local printer or retransmitted to a higher system level.



Principle diagram of the event reporting of the SPACOM system.

**Address code** The annunciator unit must be given an address code in order to enable communication with higher system levels. The address code may be any number from 1 to 99 and it may be entered through the matrix display and the front panel keys using the MODULE ADD.CODE parameter. Via the serial interface the address code may be given (if a previously given address code is to be changed) using the V200 parameter:

V200 1...99 = module address code

**Data transfer rate** The normal data transfer rate of the SPA-bus is 9600 Bd. The transfer rate may be reduced if required. Through the matrix display and the front panel keys the change is performed using the DATA TRNSF RATE menu and via the serial interface using the V201 parameter:

V 201 1 = 9600 Bd, the module regularly transmits synchronizing signals. This feature is used for synchronizing the flash sequences of two or more interconnected annunciator units without a higher system level incorporated.

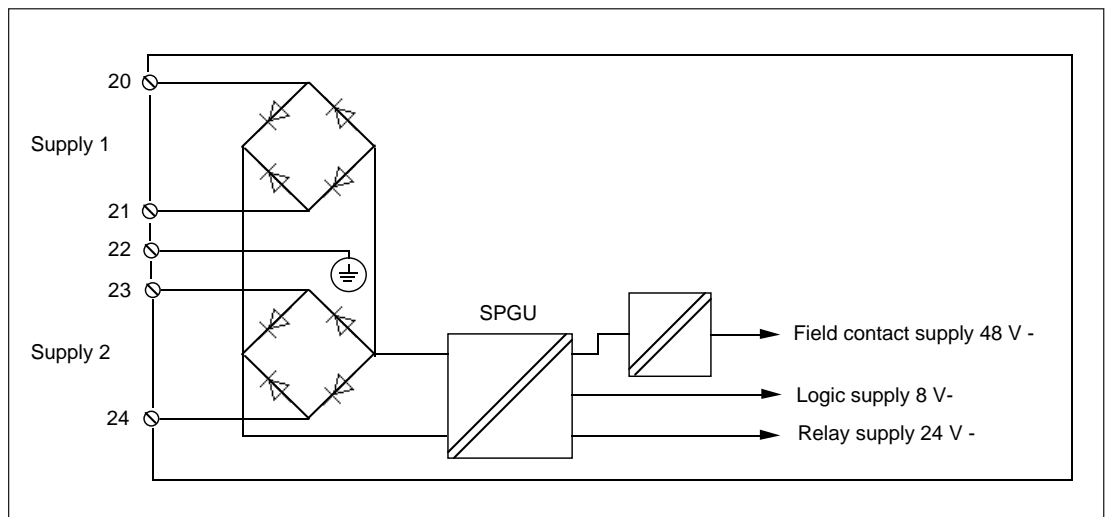
- 2 = 9600 Bd
- 3 = 4800 Bd
- 4 = 2400 Bd
- 5 = 1200 Bd
- 6 = 300 Bd

**Auxiliary power supply**

Supply voltage range

The standard auxiliary power module of the annunciator unit covers any ac or dc auxiliary voltage within the range 80...265 V. On request the annunciator unit is provided with an

auxiliary power module intended for the supply voltage range 18...80 V dc. The auxiliary power modules are provided with two identical supply inputs. Generally only one is used.



Principle diagram of the auxiliary power supply system.

## Double supply

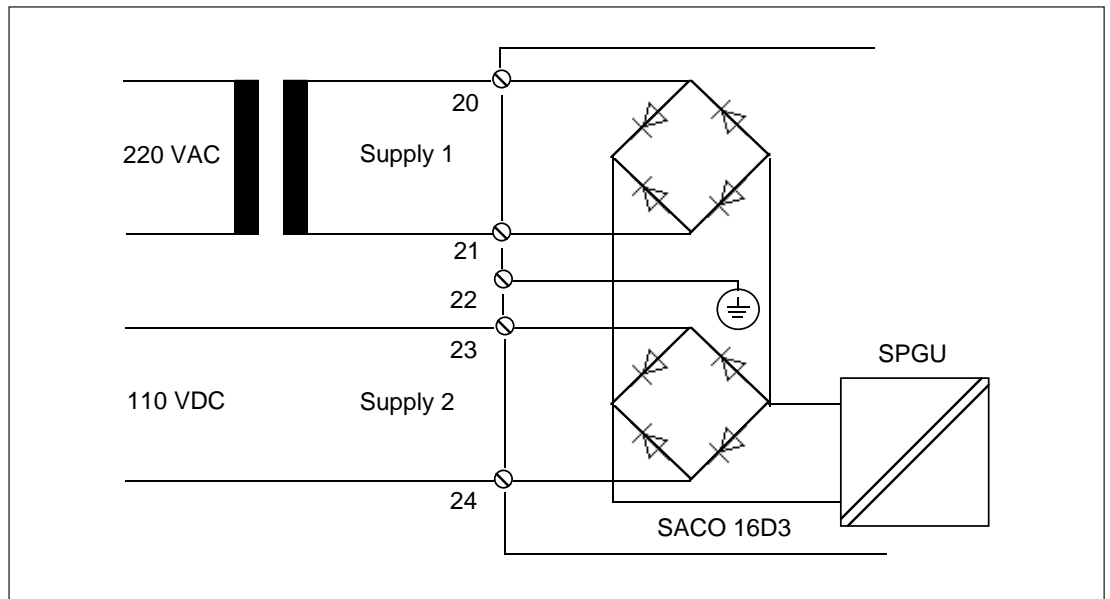
When the annunciator unit is to be supplied from two sources it must be noted that the two supply inputs of the auxiliary power module are galvanically interconnected. For this reason one of the supply sources must be fitted with a galvanic separation. The galvanic separation may be carried out by means of an isolating transformer in ac circuits or a DC/DC-converter in dc circuits. The most common solution is that one of the inputs is energized from an AC source and this supply is provided with an isolating transformer,  $\geq 30$  VA, with an output voltage within the range 80...265 V. The other input may then be connected to a dc source, e.g. a station battery, also within the range 80...265 V dc. The auxiliary

power source with the highest voltage level will be the one supplying energy to the annunciator unit.

The dielectric test voltage between the auxiliary supply inputs and the electronics of the annunciator unit is 2 kV, 50 Hz, 1 min.

N.B.

No double supply can be arranged using the supply module for the input voltage range 18...80 V DC. In this case, on the other hand, the auxiliary supply inputs are paralleled in order to avoid overloading of the input circuits, especially if the 24 V DC outputs are used for the supply of transducer amplifiers.



Principle diagram of a doubled auxiliary supply.

In the above figure Supply 1 is 220 V ac fed over an isolating transformer with the transforming ratio 1:1, Supply 2 is a DC supply taken from a 110 V station battery.

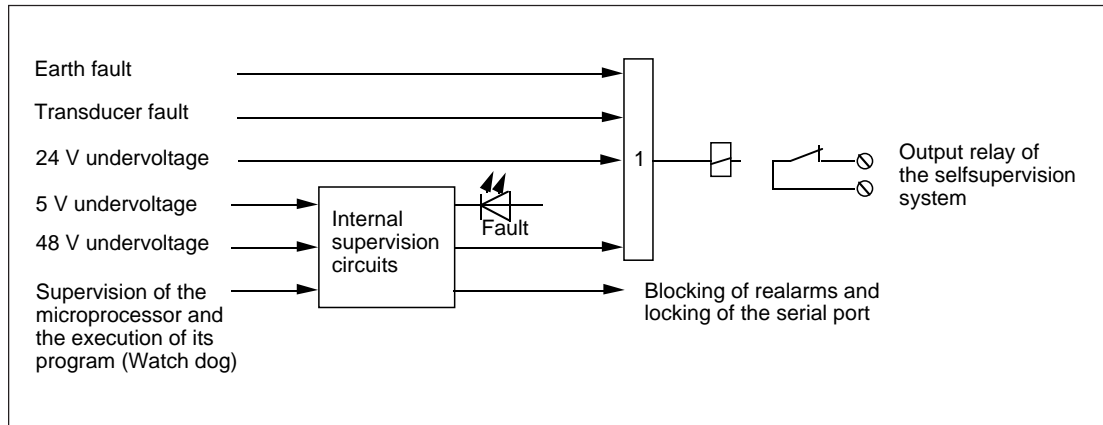
Thus in the above example energy is normally taken from the AC supply and the DC supply immediately takes over if the AC supply fails.

## Self-supervision

The built-in self-supervision system continuously supervises the internal voltages of the annunciator, the operation of the microprocessor programmes and the function of the electronics. On detection of an internal malfunction an automatic reset and reinitiation is carried out. If the failure disappears, the normal operations continue.

The self-supervision system controls two LED indicators marked ON and FAULT on the front

panel. If a fault is detected in the program execution, in the function of the electronics or in the supply voltage levels, the FAULT indicator goes on and the self-supervision system output relay operates closing a NO contact. If the supply voltages disappear too, the ON and the FAULT indicators both turn off. The output relay of the self-supervision system operates (the relay drops off and its contact closes) even in this case because the output relay is energized under normal conditions and the output contact is open.



Principle diagram of the self-supervision system.

## Mounting

The housing of the annunciator unit is primarily intended for flush mounting. The case is fixed to the panel by means of two pairs of mounting brackets. The annunciator unit is preferably mounted in eye-height.

The required depth behind the panel may be reduced by means of a raising frame which may be ordered separately. The correspondingly shorter mounting brackets are delivered together with the raising frame. Three types of raising frames are available:

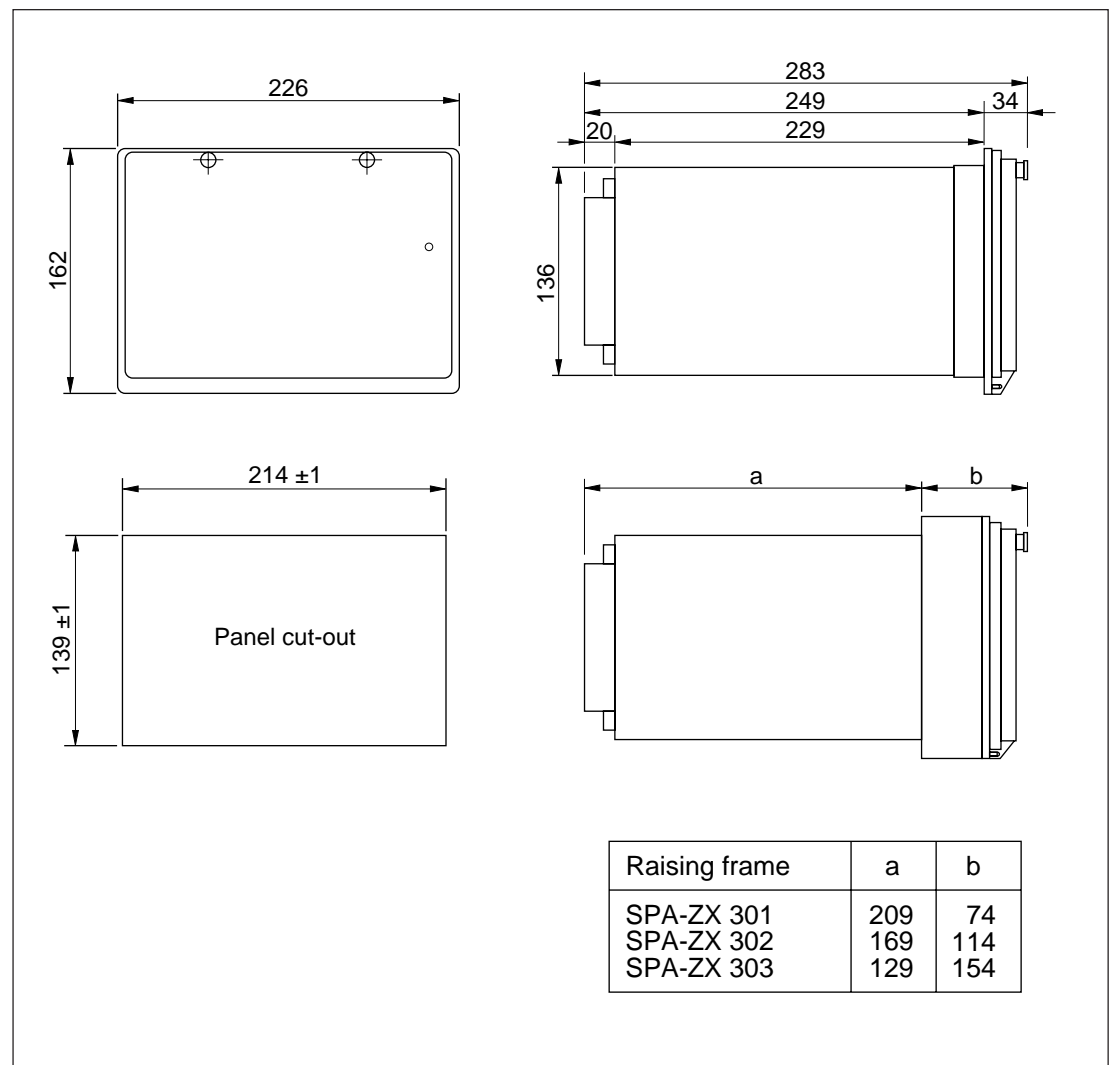
- type SPA-ZX 301, raising frame, 40 mm
- type SPA-ZX 302, raising frame, 80 mm
- type SPA-ZX 303, raising frame, 120 mm

The mounting frame of the annunciator case is fitted with a rubber gasket, which provides a degree of protection by enclosure to IP54 between the annunciator case and the mounting panel.

The annunciator units may also be mounted in 19 inch instrument cabinets and mounting frames. For this purpose three types of mounting plates are available among the accessories. The height of the mounting plates is 4U (~178 mm) and the following types have been specified.

- type SPA-ZX 304, mounting plate for two size 300 cases
- type SPA-ZX 305, mounting plate for one size 300 case
- type SPA-ZX 201, mounting plate for one size 300 case and one size 100 case

## Dimensional drawings

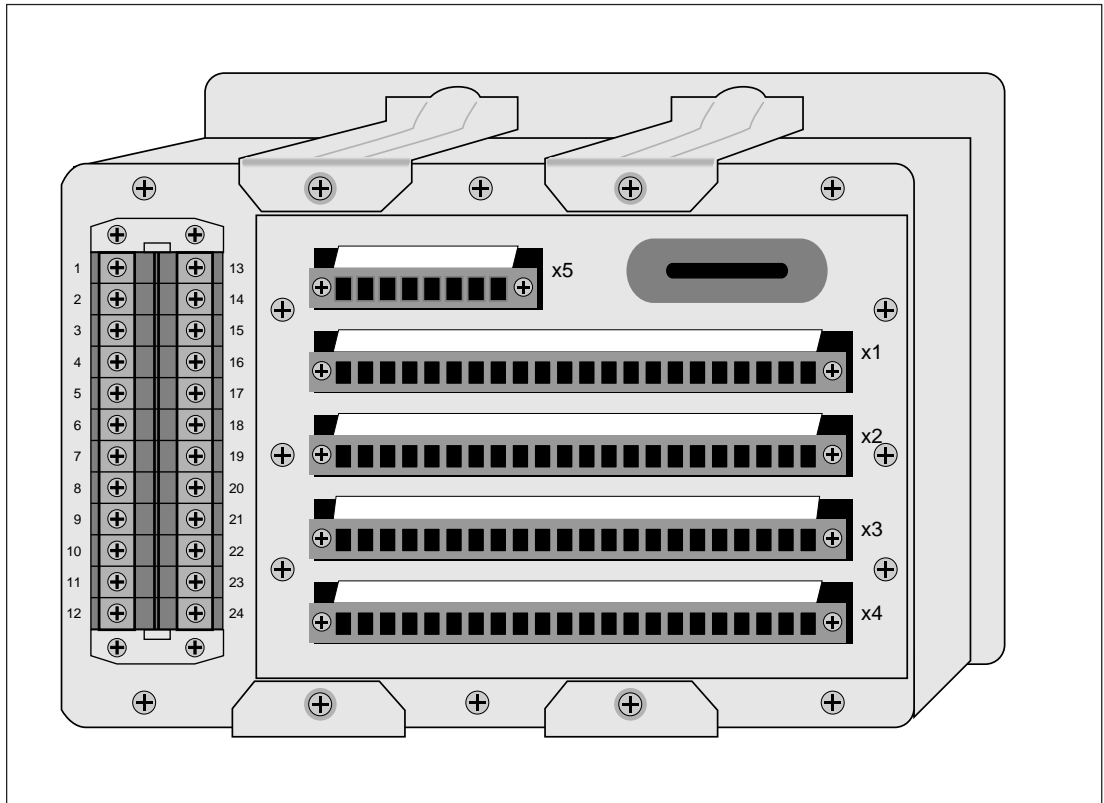


## Connection

All terminals to facilitate input and output connections are located on the rear panel of the annunciator unit. The connector module carrying the transducer input connectors and the remote control input connectors is detachable. Thus it may be used as a separate connection socket when the annunciator unit is mounted, for instance in a control desk, in which case it must be provided with a longer interconnection cable. The space of the connector module is covered with an optional sheet steel plate.

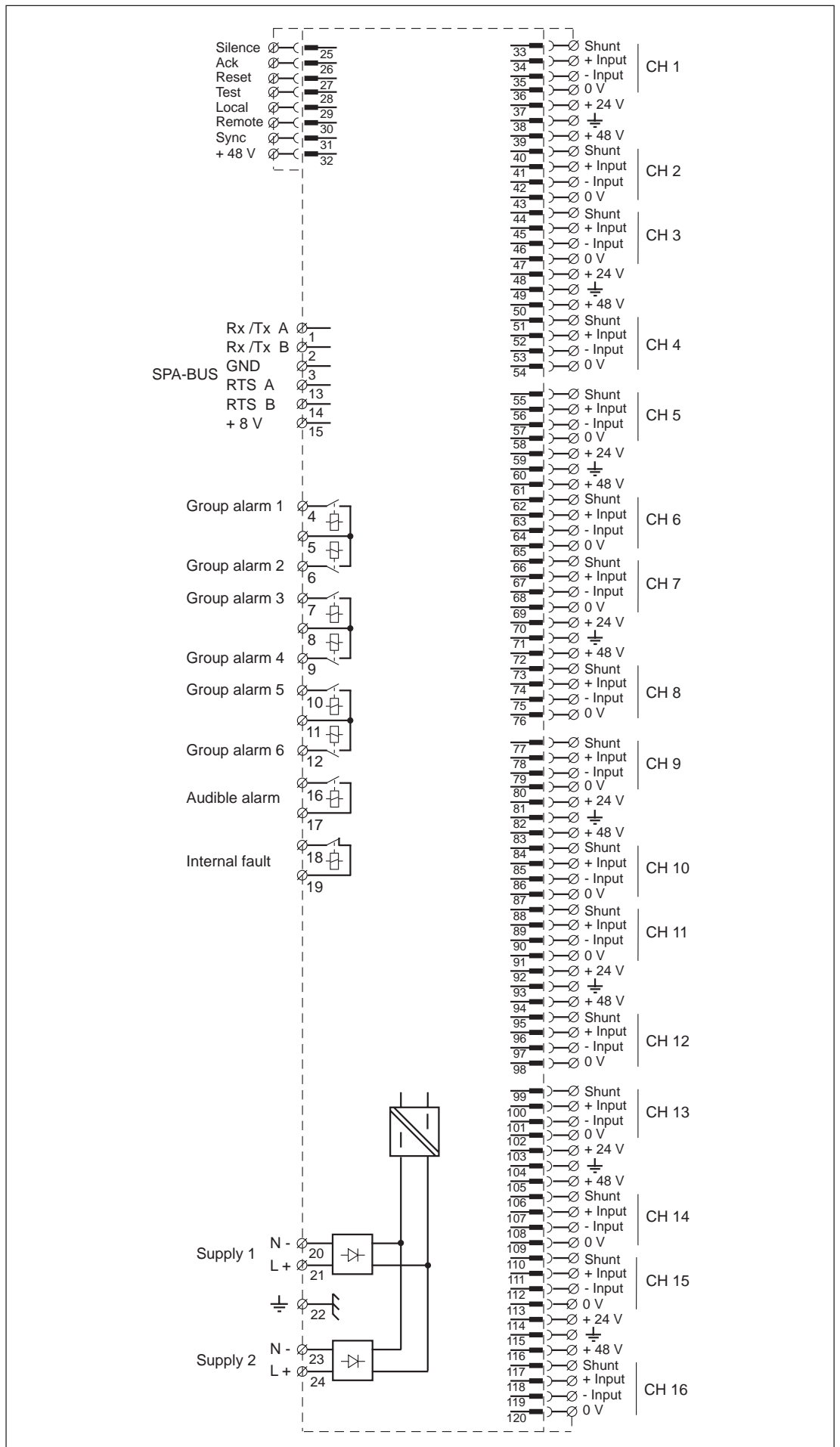
To facilitate the connection of the auxiliary voltages, the relay output circuits and the bus connection module the annunciator unit is provided with terminal blocks for screw connection. Each terminal may accommodate one or two wires with a max. cross section of  $2.5 \text{ mm}^2$ .

The transduce input signals and the remote control signals are connected to detachable screw terminal connector strips. Each terminal may accommodate a multistrand wire of  $0.5 \dots 1.5 \text{ mm}^2$ . The connector strip is of the Weidmüller type BLA-SLA.



Rear view of the annunciator unit SACO 16A3.

# Connection diagram



Connection diagram of the annunciator unit SACO 16A3.

## Power supply

Before the auxiliary voltage is connected to the annunciator unit it must be checked that the voltage complies with the specification of the auxiliary voltage of the unit. See marking on the aluminium profile. Also check that the equipment earth has been connected.

When the annunciator unit is to be supplied from two voltage sources the sources must be galvanically separated from each other. As no galvanic separation of the voltage sources is provided by the power module of the annunciator unit, it must be arranged outside the unit. See example in section "Double supply".

N.B. If the annunciator unit is to be supplied from two auxiliary energy sources, a galvanic separation must be arranged to one of the supplies, e.g. using an isolating transformer. Please, cf. the chapter "Double supply".

If the supply alternative 18...80 V DC is used, it is recommended that the two supply inputs of the annunciator unit are paralleled, in order not to overload the supply input circuits, especially if the 24 V DC output is used for the supply of energy to transducers.

## Relay outputs

The group realarm outputs are connected two and two with one common wire. The audible alarm and the self-supervision alarm outputs are, however, fully separated from each other. All the outputs relays have been set to provide a contact closing on operation. The relay board type SWOM 8A1 carries solderable programming pins by means of which the contact function of each output relay separately may be altered from normally open to normally closed, cf. the following list:

### Audible alarm

J1 o o-o = NC contact, o-o o = NO contact

### Self-supervision

J2 o-o o = NC contact, o o-o = NO contact

### Group realarm 1

J3 o o-o = NC contact, o-o o = NO contact

### Group realarm 2

J4 o o-o = NC contact, o-o o = NO contact

### Group realarm 3

J5 o o-o = NC contact, o-o o = NO contact

### Group realarm 4

J6 o o-o = NC contact, o-o o = NO contact

### Group realarm 5

J7 o o-o = NC contact, o-o o = NO contact

### Group realarm 6

J8 o o-o = NC contact, o-o o = NO contact

## Remote control inputs

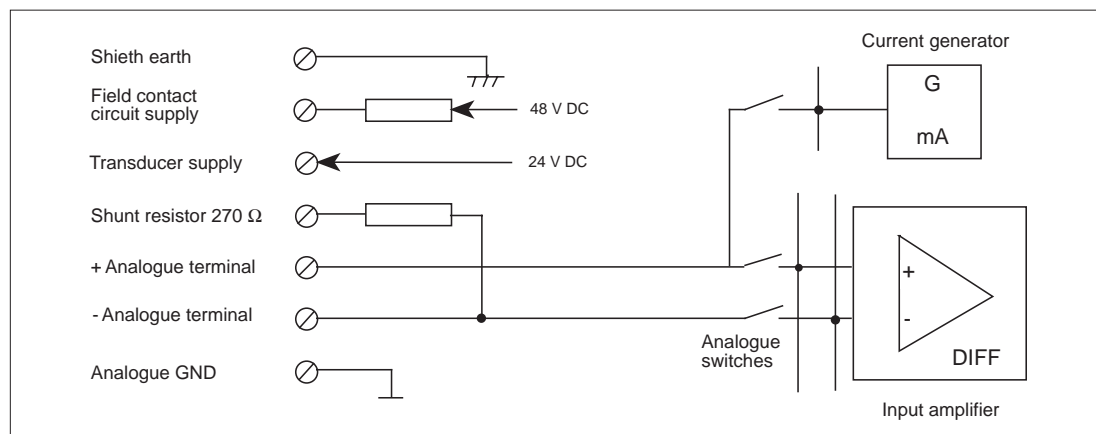
The remote control inputs are to be controlled by closing contacts. The control circuit voltage,

48 V dc, may be taken from the 48 V dc output of the annunciator unit.

## Transducer inputs

The transducer circuits are wired to the connectors X1...X4. For each annunciator channel four connection screws have been reserved. Fur-

ther, three connection screws have been reserved per every two channels.



Principle diagram of the connection of a transducer.

The earth terminal is connected to the protective sheaths of the transducer input cables. When the input cables are individually screened two

sheaths are connected to one earth terminal. The cable sheath is generally earthed in one end of the cable only.



Transducer connections

The annunciator unit may be connected to a large variety of different measuring transducer types, both standardized and customer-speci-

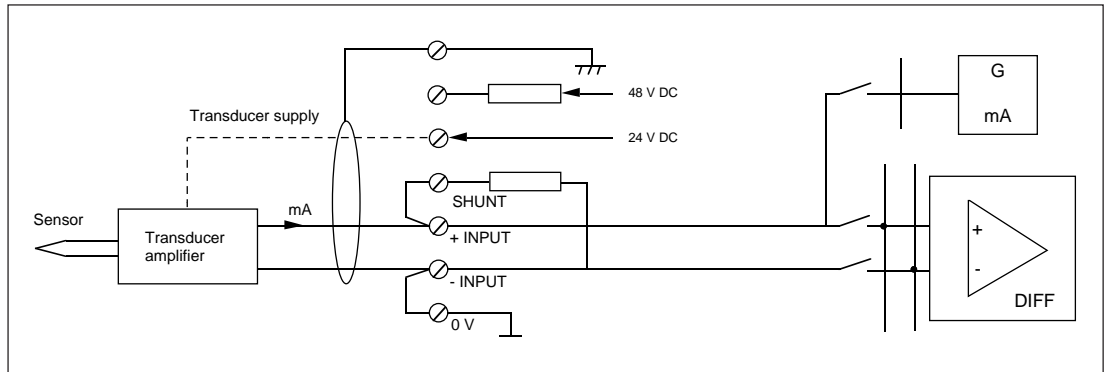
fied types. The different transducers are connected to the channel inputs as follows.

Current transducers

When a current transducer is connected to the channel input, the terminals SHUNT and +INPUT are linked together as are the terminals GND and -INPUT too. The incoming current signal is connected to the +INPUT terminal and the outgoing current signal to the -INPUT terminal. In case the transducer requires an auxiliary supply, it may be taken from the +24 V terminal, which is a common terminal for two channels.

The permitted current drain from the +24 V terminal is 320 mA. Field transducers without a return lead are connected to the +24 V terminal and the +INPUT terminal.

If an external shunt resistor is to be used, it should be connected between the terminals +INPUT and -INPUT. The channel input may then be programmed for e.g. the measurement range 0...1 V.

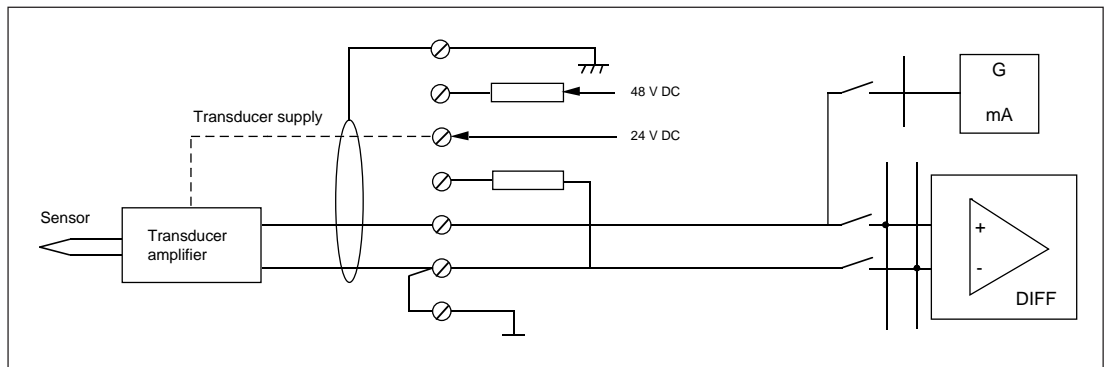


Principle diagram for the connection of current transducers.

Voltage transducers

When a voltage transducer is connected to the channel input, the GND and the -INPUT are linked together. The incoming voltage signal is connected to the +INPUT terminal and the

return voltage signal lead to the -INPUT terminal. If required, the transducer may be powered from the 24 V dc terminal.



Principle diagram for the connection of voltage transducers.

The resistance transducers may be connected to the channel input using either the three-wire or the two-wire connection principle. In the three-wire measuring principle an automatic compensation of the transducer wire resistance is provided. When the two-wire measuring principle is used the compensation of the conductor resistance must be carried out manually by first calculating the temperature change of a particular transducer as a function of the conductor resistance. The scaling is then altered so that it is moved down with the value corresponding to the conductor resistance. The scaling is moved down in both the 0% end and the 100% end of the measuring range.

Example:

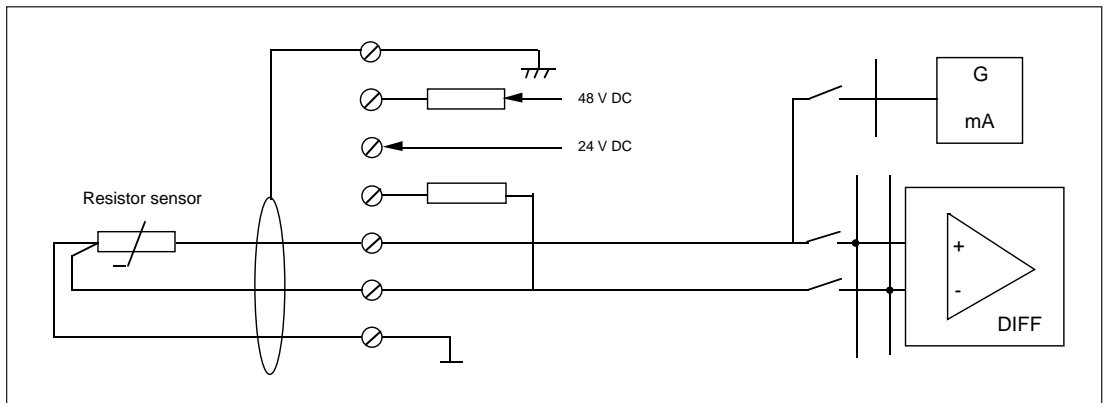
The conductor resistance of a Pt 100 sensor is  $1.2 \Omega$  corresponding to a calculated temperature change of  $3^\circ\text{C}$ . The scaling is then defined so that in stead of the range  $-20 \dots 230^\circ\text{C}$  the value  $-23^\circ\text{C}$  is keyed in at the 0% end of the scale and the value  $227^\circ\text{C}$  in the 100% end of the scale.

The temperature measurement range may also intentionally be transferred downwards by inserting a series resistor in the temperature sensor circuit. The resistor, corresponding to the tem-

perature value by which the measurement range is to be transferred, is to be connected to the +INPUT terminal. The scaling is then transferred downwards following the description given in association with the two-wire connection.

If the channel input is programmed for one of the adjustable resistance ranges, the calibration is performed with the potentiometer on the front edge of the analogue input module SWAM 16A1. The potentiometer is made accessible by dismantling the front panel of the annunciator unit. In order to enable the calibration of the channel input a resistor corresponding to  $0^\circ\text{C}$  of the particular sensor is to be connected to the input. The channel to be calibrated is then called up on the display and the potentiometer is turned until the display shows  $0^\circ\text{C}$ . The calibration is now finished and the front panel may be refitted. The calibration is valid for any channel which has been programmed for the adjustable scale. Only one adjustable scale per annunciator unit may be defined.

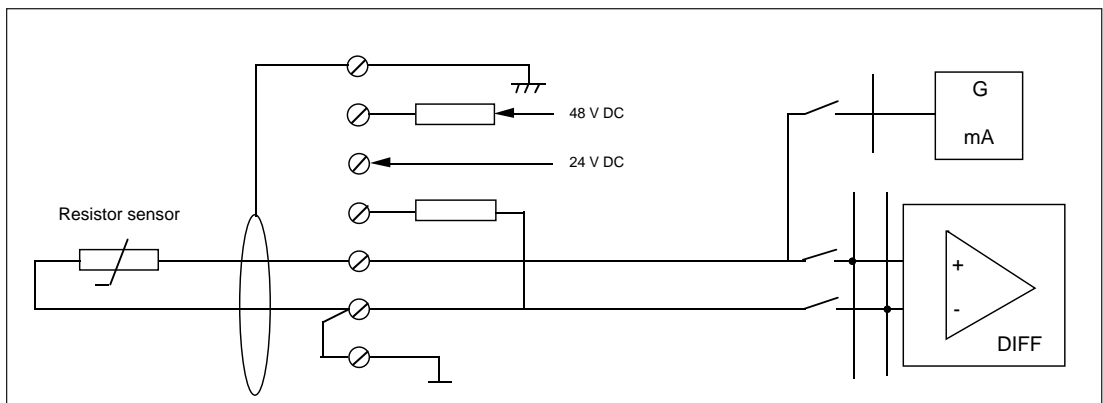
In the three-wire connection the sole wire is connected to the +INPUT terminal and the two parallel wires are connected to the -INPUT and GND terminals respectively.



Principle diagram of the three-wire connection.

In the two-wire connection the -INPUT and GND terminals are linked together. The resis-

tor is connected across the input +INPUT and -INPUT



Principle diagram of the two-wire connection.

Field contact signals

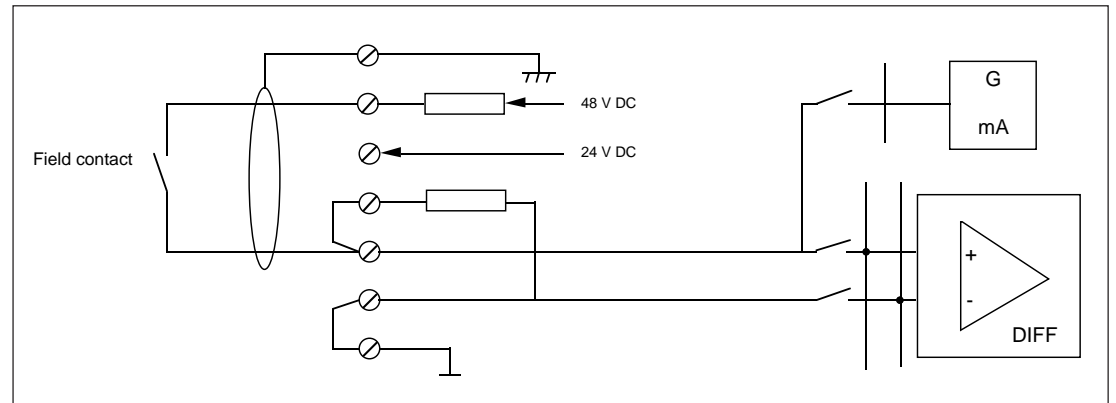
The internally generated 48 V dc voltage is used as the field contact circuit voltage. The 48 V dc terminal is fed over an internal series resistor. Thus, when the field contact closes the terminal potential drops to a few volts. Therefore each field contact must be supplied via a 48 V dc terminal, despite the fact that two channels share one +48 V dc terminal.

The internally generated 24 V dc may be used for feeding the field contact circuit too, but if the 24 V dc terminal is used it must be provided with a 4.7 kΩ series resistor.

Further the SHUNT and +INPUT terminals are linked together as are -INPUT and GND terminals too.

The field contact is then connected either across the 48 V dc and the +INPUT terminals or with the 4.7 kΩ series resistor across the 24 V dc and -INPUT terminals.

The channel input is programmed to accept a closing field contact by setting a HI set-point in the middle of the measurement range and for an opening field contact a LO set-point is keyed in the middle of the measurement range.



Principle diagram of a field contact connection.

Serial bus connection

A series of bus connection modules used for connecting the annunciator unit to the SPA-bus is described in section "Bus connection modules". The bus connection modules are attached

to one of the terminal blocks by means of the enclosed fastening sleeves and according to the enclosed mounting instruction.

Interlocking bus connection

To enable the 16-pole flat cable to be connected to the interlocking bus, the input connector module must be dismantled. The flat cable is then routed through the aperture of the rear

plate and connected to the flat cable connector X9 on the mother PC board. Thereafter the input connector module is refitted.

Annunciator start-up

Starting is indicated on all occupied channels as a reset alarm. These "alarms" are not stored in the event register.

An operational test may be performed to the annunciator unit by putting it into the test mode. During the test all display and indicator functions are went through. The alarm channel indicators are tested both with respect to discon-

tinuity of light emitting diodes and short-circuit between adjacent light emitting diodes. The digital display goes through each number and the matrix display shows a positive and a negative picture. In this way every pixel of the matrix display will be checked.

The input and output circuits of the annunciator unit must be tested using primary test methods.

## Edition and change of channel legend foil

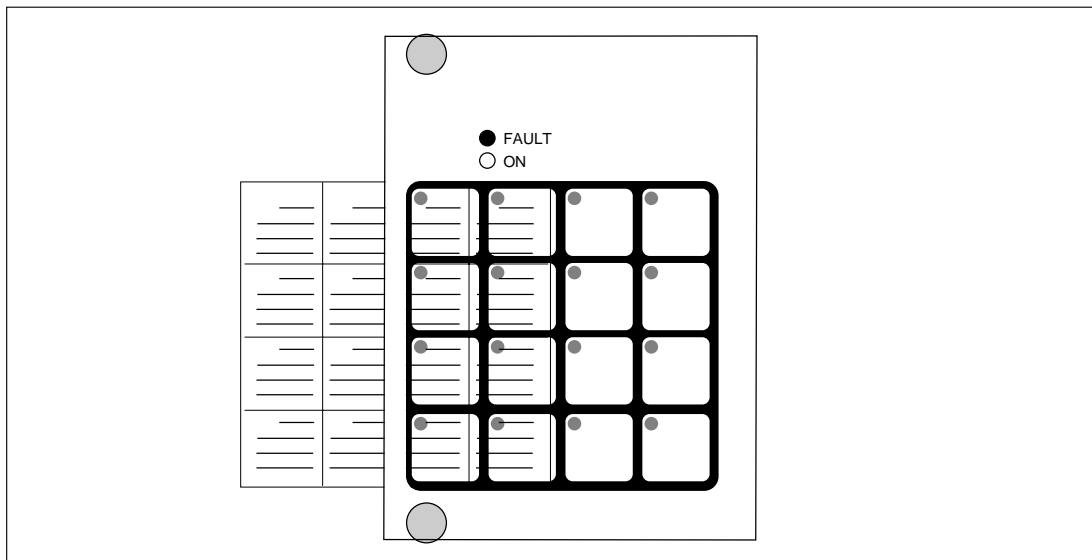
The annunciator unit is provided with a translucent foil for channel legends. The legend foil which is cut out from a sheet of ordinary drawing film, is inserted in a pocket behind the aluminium front panel. After the front panel has been dismantled the legend foil may be withdrawn from the pocket at the left hand edge of the front panel.

The channel legend text may be written with a

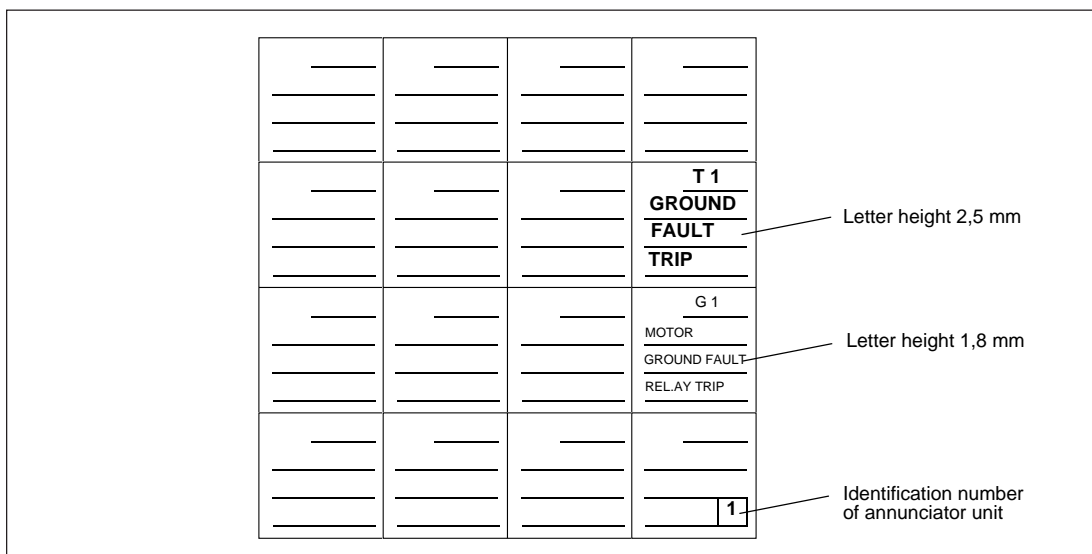
drawing ink pen or a typewriter. When the first line is written a few millimetres from the beginning of the line must be left empty in order not to cover the LED indicators.

The legend surface of one channel comprises 20 mm x 20 mm. The text may be divided into four lines.

A sheet of film with three printed legend foils are included in the delivery.



Front panel with partially withdrawn legend foil.



Legend foil with two examples of written texts.

## Programming

The annunciator unit is characterized by its versatility. At the same time it is extremely easy to use. The annunciator unit is fully customizable according to the user's requirements, as all the parameters are programmable and stored in reprogrammable solid state memory circuits. The parameter settings and changes may be entered afterwards which markedly facilitates start-up work. The setting and configuring may be performed through the push-buttons and the

matrix display on the front panel or via the serial port of the unit.

### IMPORTANT!

The annunciator unit is set and configured as an off-line measure, which means that the annunciator unit is switched off from the normal functions as long as the setting and configuring goes on.

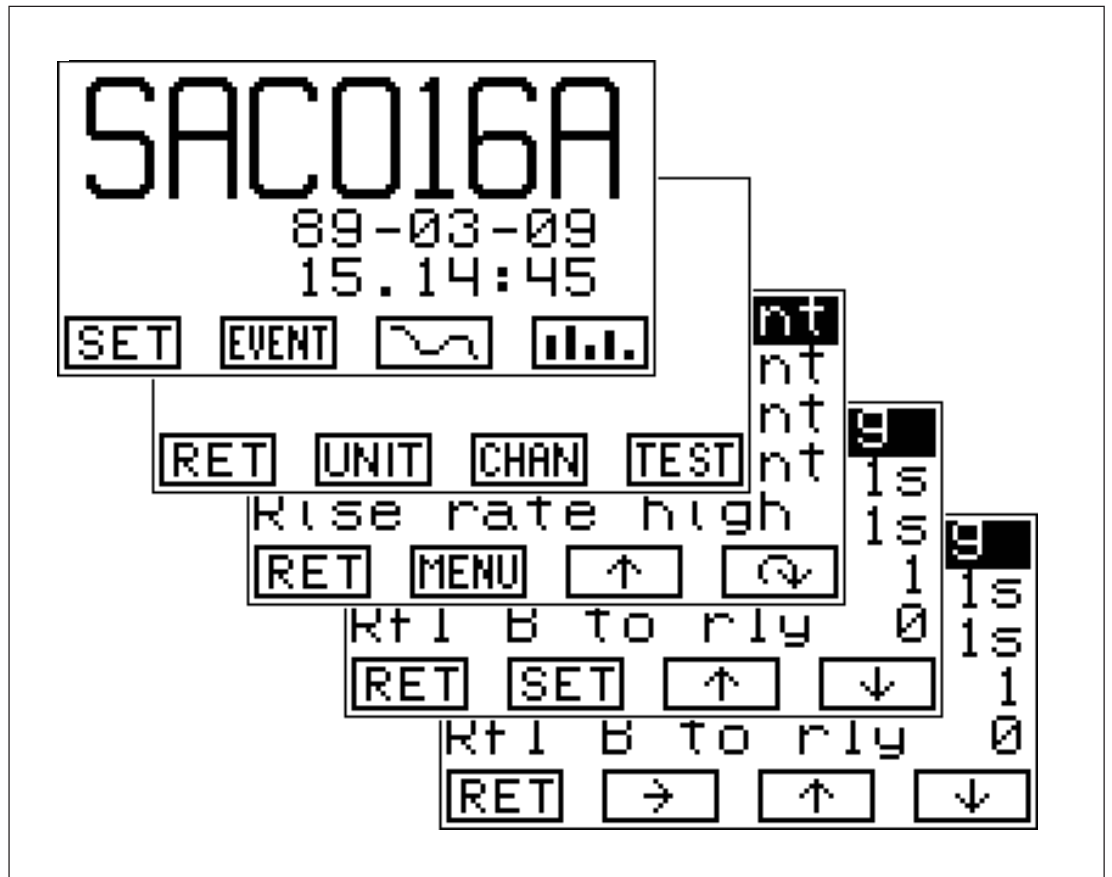
Setting through the display and the push-buttons

The annunciator unit can be programmed with the display and the plain-text push-buttons. The display always shows the meaning of the push-button. Each time the annunciator unit is started up or the left-most push-button is pushed, the basic display appears on the screen. Besides the basic display four subdisplays are used, namely:

- the channel selection display through which the module parameters and the channel parameters are selected

- the main menu display on which the basic functions are presented in plain text
- the submenu display on which parameters related to the basic function are presented
- the setting display on which parameter values of a submenu may be altered

A return to the previous display is always obtained with the RET push-button (Return push-button).



The five displays used in programming.

Basic display



From the basic display access to the setting and configuration functions is obtained by pushing the SET push-button. First a channel selection display appears on the screen.

Channel selection display



parameters may be selected. Module-related parameters are obtained by pressing the push-button under the UNIT text. Channel-related parameters are called up by pressing the push-button under the CHAN text. Channel 1 is first obtained. The presented display is called the basic menu.

Through the channel selection display both module-related (channel 0) and channel-related

From the channel selection display access to the test functions is obtained with the TEST push-button.

Basic menu display



be checked or altered is selected. The functions are presented in plain text without setting values.

The upwards pointed arrow is used for scrolling through the menu. The currently selected function is shown in light on a black background. If the basic menu shows a channel-related function the following channel may be reached with the semicircular arrow. Then, with the MENU push-button the desired submenu display is reached.

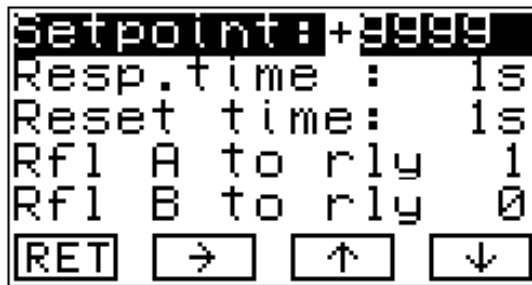
Through the above display the basic function to

Submenu display



In this display all the setting values associated with the basic function are shown. Even in this display the menu may be scrolled through using the arrow push-buttons. The selected parameter is shown in light characters against a dark bottom. If the selected parameter value is to be altered the setting display is called up using the SET push-button.

## Setting display



In the setting display either the selectable values of a particular setting or the previous setting value if freely selectable, are shown. The selected value is flashing and shown in light characters on a dark background.

The selectable values are selected with the upwards and downwards pointed arrows. The value pointed out at the moment the display is abandoned using the RET push-button is stored in the memory.

At an adjustable setting the first digit flashes. This digit may be altered by stepping through the selectable set of characters using the upwards and downwards pointed arrows. The following digit starts flashing when the rightward arrow is pushed and again the desired character may be selected. In this way the desired setting value may be obtained in the display. When the display is abandoned using the RET push-button the selected value is stored in the memory.

## Programming via the serial bus

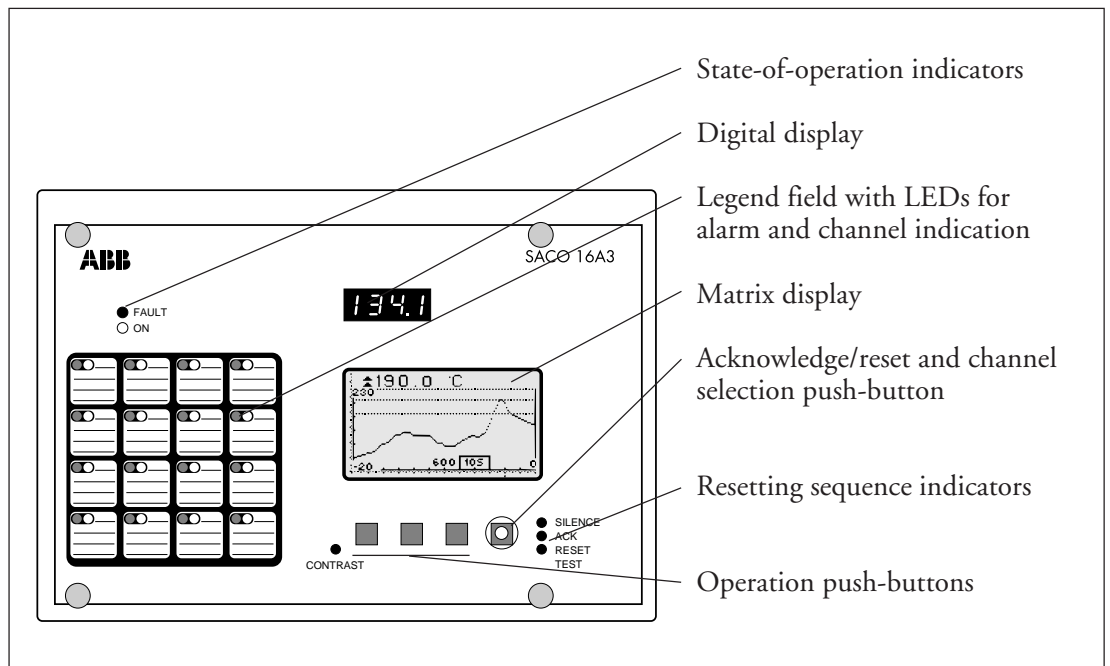
The annunciator unit may also be configured and set with instructions given via the serial port using the codes defined later on in this product document. The programming routines are the same as for the other SACO units and is easily

carried out using e.g. an SMS program. When a higher level connection is used for the programming, additional information is to be found in the SPA bus protocol description, i.e. the document no. 34 SPACOM 2EN1.

## Operation

The analogue annunciator unit is easy to use. The user simply pushes the front panel push-buttons to perform resetting functions or to read measured values. However, for shifting displays and for programming the cover is to be opened to provide access to the front panel push-buttons. The functions corresponding to the adjacent push-buttons are shown in the matrix display.

The state of operation of the annunciator unit is indicated with two LED indicators in the upper left corner of the front panel. Under normal operation conditions the ON indicator should be illuminated indicating that the auxiliary supply of the unit has been switched on. If the FAULT indicator is illuminated an internal fault has been detected by the integrated self-supervision system.



Front view of the annunciator unit.

Resetting of set-point transition

On transition of a set-point value the indicator of the concerned alarm channel is activated according to the selected annunciator sequence and the digital display shows the channel number of the first-out alarm succeeding the last resetting. The group rearm output relays configured to the particular set-point value transition are also operated. Further, the resetting sequence indicators perform according to the selected annunciator sequence pattern. The unit incorporates the following resetting functions:

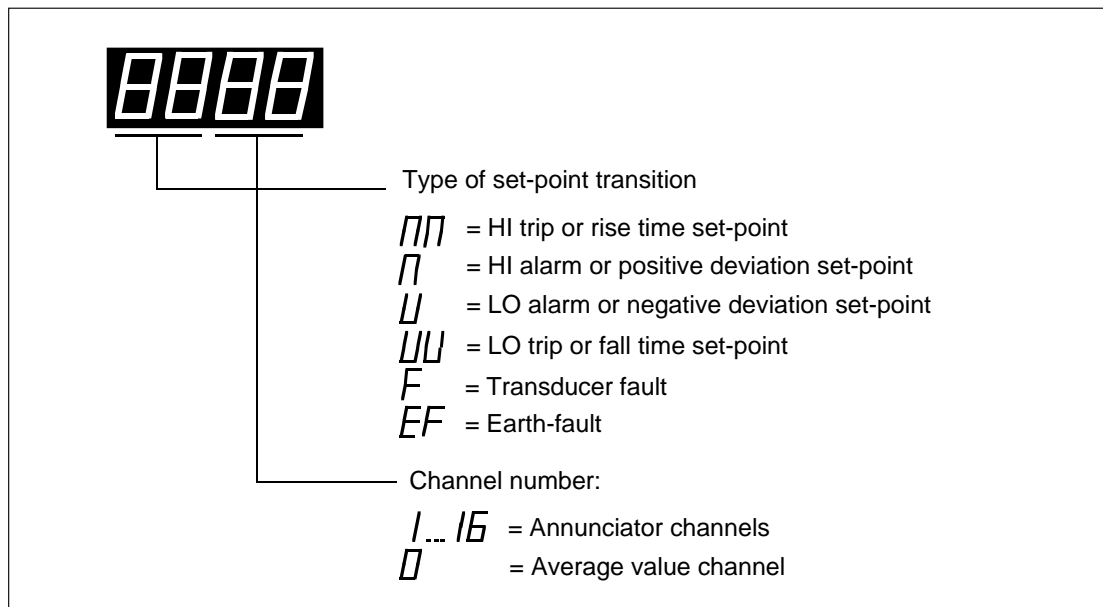
SILENCE = resetting of audible alarm  
ACKNOWLEDGE = alarm acknowledge  
RESET = channel reset

The resetting function being performed when the reset push-button is pressed is the one currently being indicated by the adjacent LEDs. Separate inputs are available for the various acknowledge/resetting functions when they are to be performed by remote control.

Indication of first-out alarms and transducer faults

The channel number of the first-out alarm succeeding a resetting is shown in the digital display and it is maintained in the display until being reset. Meanwhile the measurement value display is interrupted and it reappears when the

resetting is performed. An earth-fault indication, however, is maintained until the earth-fault is eliminated. The first-out alarm is displayed in the following form.



Function testing

The annunciator unit may be commanded into a function testing mode where the indicators are illuminated in a certain sequence pattern. After opening the front cover the testing mode is entered by first pressing the SET and then the TEST push-button of the basic display. The function test also includes the microprocessor.

After the function test the desired matrix display function is re-selected.

Normally the transducer circuits are continuously supervised by the annunciator unit. The function of the output relays are, however, to be verified by primary testing.



## Display of measured values and event register contents

Measured values

The measured values are displayed on the digital display in scaled quantities on a per channel basis. The channels are called up in a sequence one by one with the push-button on the front cover. A yellow LED indicator in the legend field of the channels indicates which channel is up for display. If the average value function has been taken in use the average value will be

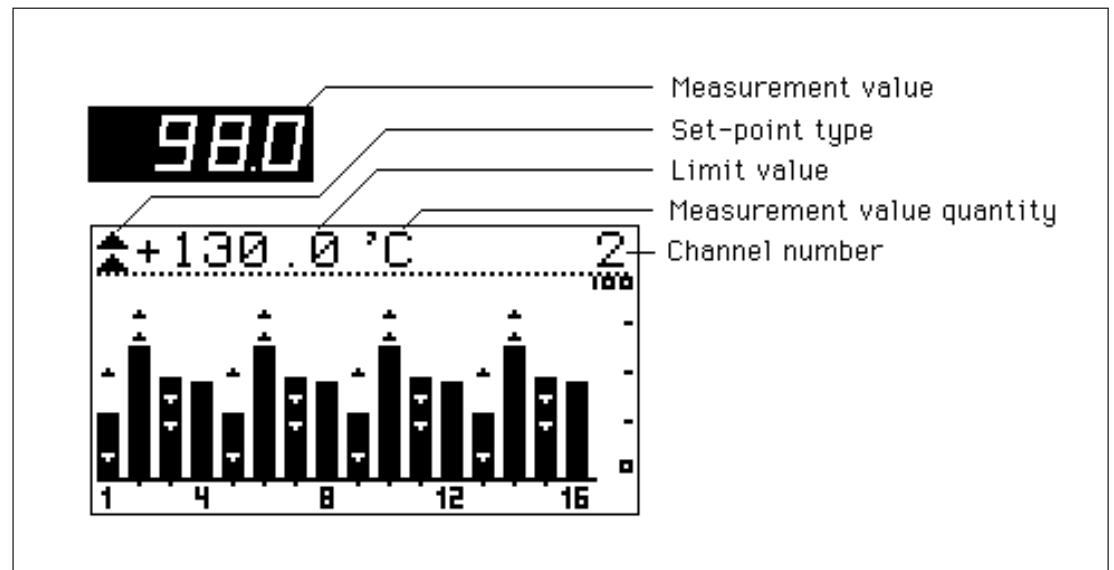
presented after channel 16. Then, in stead of the channel number the letters AV will be displayed on the matrix display.

The measurement value display function may be used independently of the selected mode of operation of the matrix display.

Limit values and measured quantities

Simultaneously with the measured value being displayed on the digital display, the limit values, the measured quantity and the channel number are being presented on the first line of the matrix display. If several limit values have been set, the different values are shown successively with

three seconds intervals. The TRIP set-points are marked with two arrow heads and the ALARM set-points with one. The arrow heads point upwards for HI set-points and downwards for LO set-points.



Measurement value presentation.

Further the matrix display may be given the following modes of operation:  
– bar graph mode survey display of all the 16 channels

– curve display mode with selectable time axis  
– event register display mode with the latest four events on the screen

Selection of display mode

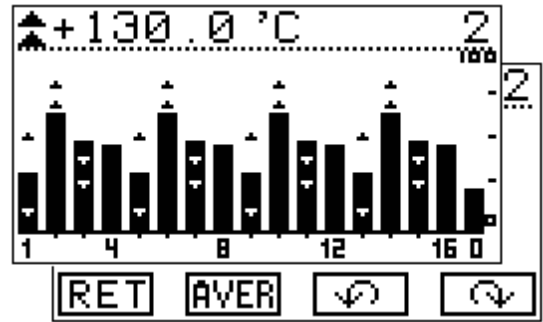
The matrix display modes are selected by means of the push-buttons on the front panel, after that the front panel cover has been opened. If the basic image with the date and time marks are shown on the display, the bar graph mode may be obtained simply by pressing the bar graph

push-button, the curve mode by pressing the curve mode push-button and the event register display mode by pressing the EVENT push-button. When a new display mode is to be selected the basic image is first called up using the left-most RET push-button.

### Bar graph display mode

The measured values of all the channels may be presented in one image. The measured values are displayed in the form of bars with a 0...100 % scale of the display range, when the measured value is displayed in the curve mode. The standard programming equals the measurement range for the concerned transducer. However, the display range may be freely selected using the CURVE TRACE parameter. The set-points of the various channels are marked with upwards directed arrow heads for the HI set-points and downward arrow heads for the LO set-points. The display provides a survey of the value of all the channels in relation to the set limit values. If the value of a channel lies close to a set-point the

concerned channel may be studied more closely by calling up the channel on the digital display.



Bar graph display mode.

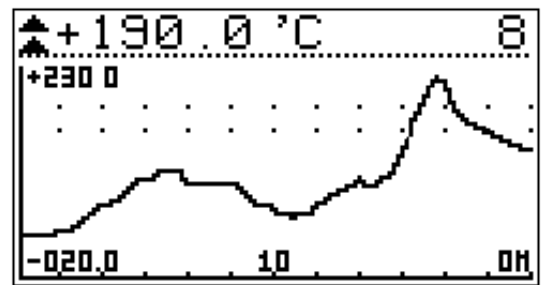
### Curve display mode

The measured values of the channels may be presented as a curve in a system of co-ordinates with a selectable horizontal time axis. The channel to be studied is selected using the right-most push-button which is used for alarm resetting too.

The measured values are presented as scaled values of the selected measured quantity. The end values of the measurement value range are shown in the left-most upper and lower corners of the screen. The scale range for the curve display mode may be selected from the basic menu using the CURVE POINTS parameter. In the submenu HI POINT stands for the upper end value and LO POINT for the lower end value.

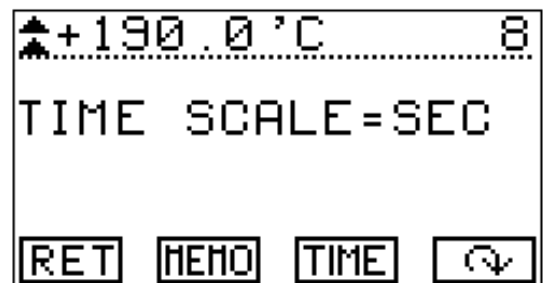
The default programming on delivery equals the measurement range, but the requested display range may be set by the operator. For each point on the time axis the maximum and minimum value for the measurement period, which the point represents, is given. The time axis may be given the following values:

- one point per second, which gives a full display time period of 2 minutes
- one point per ten seconds, which gives a full display time period of 20 minutes
- one point per minute, which gives a full display time period of 2 hours
- one point per ten minutes, which gives a full display time period of 20 hours
- one point per hour, which gives a full display period of 5 days



Curve display.

By keying one of the push-buttons the push-button mnemonics are displayed. The time axis is selected using the TIME push-button of the display. By stepping through the choice of time values the desired time axis is selected as measuring sample/time. The last value selected is stored and presented, when the curve display is selected next. The measured values associated with all the time axes are stored. This feature enables the time axis to be changed whenever requested and the curve to be studied over a shorter or longer period of time. Using the MEMO push-button one stored measurement value curve per channel may be presented. The push-button mnemonics are erased from the display with the RET push-button or automatically after time-out.



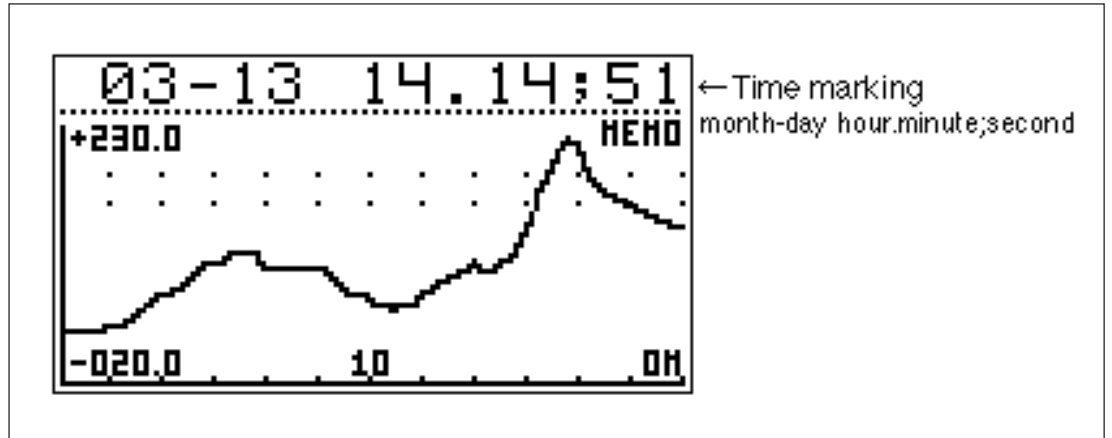
Push-button mnemonics display.

Stored measurement value curve

In addition to the continuously registered measurement value curve, a stored curve is available for each channel. The stored curve contains the latest set-point value transition and it is stored with the latest selected time axis. Of the stored curve 75 % lies before the transition point and 25 % after the point.

The stored measurement value curve is called up with the MEMO push-button.

The first line of the display shows the time marking of the set-point value transition using the following format:



Stored measurement value curve.

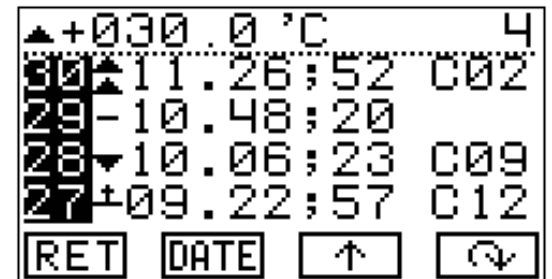
Local event sequence register

The latest thirty set-point value transitions and resettings including time markings comprising year, month, day, hour, minute and second are stored in chronological order in the register. The register is of the FIFO type which means, that when new events are received old events are deleted.

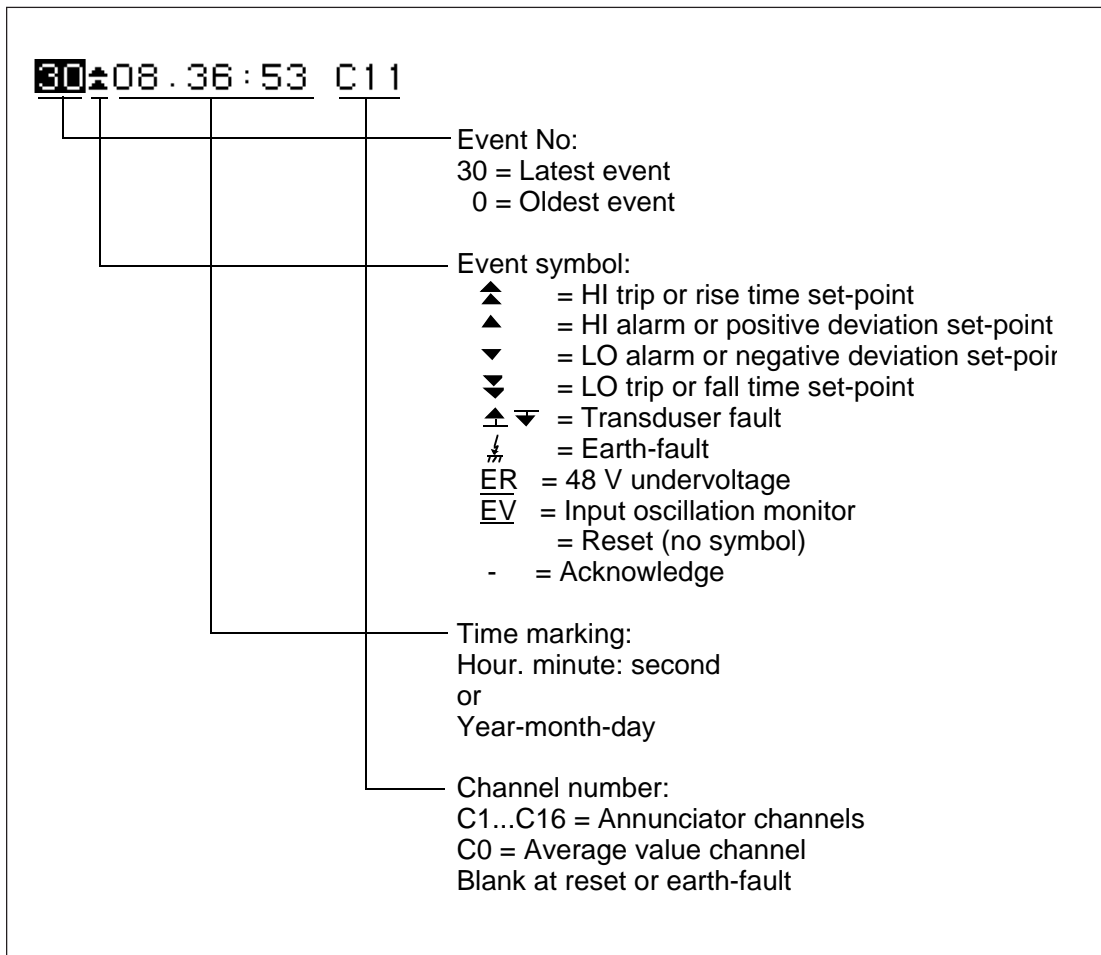
The event register presentation is finished by pressing the RET push-button.

The event sequence register is provided with battery back-up and it maintains its contents during an auxiliary supply interruption.

Access to the register may be obtained by opening the front cover and pressing the EVENT push-button of the basic display. The latest four events are then presented including the time marking in hours, minutes and seconds. By pressing the DATE push-button the time presentation is altered to year, month and day. The latest (nearest) event is on top of the stack and marked with number 30. By keying the arrow head push-button one can go back in the register. The display moves automatically to its starting point, with the latest event on top if a new event is received during the time the register is being read.



Event sequence presentation.



Key to event sequence register reading.

Display of average value

The mean value, if calculated, is presented on the digital display as the final value after all the channel values. At the same time the HI set-point value and the blocking set-point value alternate in the matrix display. In stead of the

channel number the letters AV are shown in the digital display.

The mean value may also be presented in the curve display mode, if desired.

## List of parameters

By means of the push-buttons and the displays on the front panel of the annunciator unit or via the serial port of the unit, access to all the input/output values, setting values, variables and registered values is obtained.

I = input value  
O = output value  
S = setting value  
V = variable

The parameter names used in the man-machine communication via the front panel are in plain text while the parameter names are coded with a letter and a number when communication goes via the serial port. The letter codes stand for the following parameter types:

The parameters may carry module-related information or channel-specific information. The module-related information is addressed to an imaginary channel number 0 (zero) of the annunciator unit. The channel specific information is addressed to the desired channel, i.e. one of the channels from 1 to 16.

Type of information	Displayed memo	Bus code	Value
<i>Module related information</i>			
Status of the interlocking lines	—	I1...I4	0 = not activated 1 = activated
Calculated mean value	AV	I9	0.000...+/-9999
Output relay states	—	O1...O6	0 = not activated 1 = activated
Realarm output relay function	REFL.RELAY MODE 1...6	S1...S6	0 = transition follower 1 = alarm memory follow 2 = pulse shaping 3 = 0+2
Realarm pulse length		S23	0...255 = pulse length in seconds
Alarm sequence type	ALARM.SEQUENCE	S24	0 = ISA A 1 = ISA A-1 2 = ISA M-1 3 = ISA R-1 4 = DIN 19235
Determination of reporting of active alarms (concerns the co-operation with SACO 100M)	ACT.ALARM POLL	S25	0 = responds 1 = no respond
Average value HI trip set-point	AV.TRIP POINT SET POINT	S26	0.000...+/-9999
Starting delay of average value trip	AV.TRIP POINT RESP.TIME	S32	0...255 s
Resetting delay of average value trip	AV.TRIP POINT RESP.TIME	S33	0...255 s
Grouping of reflash A from average value trip	AV.TRIP POINT RFL A TO RLY	S28	0...6
Grouping of reflash B from average value trip	AV. TRIP POINT RFL B TO RLY	S29	0...6
Average value blocking limit value	AV.BLOCK POINT SET POINT	S27	0.000...+/-9999

Type of information	Displayed memo	Bus code	Value
Starting delay of the average value blocking	AV.BLOCK POINT RESP.TIME	S34	0...255 s
Resetting delay of the average value blocking	AV.BLOCK POINT	S35	0...255 s
Grouping of reflash A from average value blocking	AV.BLOCK POINT RFL A TO RLY	S30	0...6
Grouping of reflash B from average value blocking	AV.BLOCK POINT RFL B TO RLY	S31	0...6
Selection of external reference signal channel	EXT.REF.CHANNEL	S36	0 = no channel 1...16 = one of the channels
Frequency of the ac supply	MAINS FREQUENCY	S37	0 = 50 Hz 1 = 60 Hz
Synchronizing	—	T	00.000...59.999 = time in seconds
Time setting	TIME SETTING	T	year, month, day, hour, min, second
Local/Remote selection	—	V1	1 = local/remote 2 = local state 3 = remote state
Resetting of audible alarm	—	V2	1 = resetting
Acknowledge of alarm	—	V3	1 = acknowledge
Testing	—	V4	1 = testing active
Resetting of alarm channel	—	V100	1 = resetting
Contents of overflow register in hexadecimal form	—	V51	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
Setting to zero of overflow matrix register	—	V51	0 = setting to zero
HI trip set-point activation in hexadecimal form	—	V52	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
HI alarm set-point activation in hexadecimal form	—	V53	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)

Type of information	Displayed memo	Bus code	Value
LO alarm set-point activation in hexadecimal form	—	V54	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
LO trip set-point activation in hexadecimal form	—	V55	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
HI transducer out of range activation in hexadecimal form	—	V56	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
LO transducer out of range activation in hexadecimal form	—	V57	0000...FFFF Channel 1 = LSB (least significant bit) Channel 16 = MSB (most significant bit)
Reading parameters from RAM to EEPROM memory	—	V151	1 = reading and storing
Event reporting mask in hexadecimal form	—	V155	0000...FFFF E1 = LSB (least significant bit) E16 = MSB (most significant bit)
The state of the remote ackn./reset inputs in hexadecimal form	—	V156	0000...01FF LSB = 48 V LSB+1 = synchr. LSB+2 = remote LSB+3 = local LSB+4 = test LSB+5 = reset LSB+6 = ackn. LSB+7 = silence LSB+8 = earth-fault
Annunciator unit address number	MODULE ADD.CODE	V200	000...899
Data transfer rate	DATA TRANS.RATE	V201	0 = 9600 Bd 1 = 9600 Bd flash synchr. transmitter 2 = 9600 Bd 3 = 4800 Bd 4 = 2400 Bd 5 = 1200 Bd 6 = 300 Bd

Type of information	Displayed memo	Bus code	Value
Microprocessor program version	—	V205	XXX.X = program version
Status of the unit	—	C	0 = normal status/resetting 1 = CPU reset has occurred 2 = event register overflow 3 = 1+2
Type designation of the annunciator unit	—	F	SACO 16A3
Reading of event sequence register	—	L	Time, channel number and event code
Repeated reading of event sequence register	—	B	Time, channel number and event code
Reading of active alarms	—	A	Channel number and event code
<i>Channel-specific information</i>			
Scaled measurement value of channel or contact status	—	I1	0.000...+/-9999 0 = open contact 1 = closed contact
Channel measurement value in binary form	—	I2	0000...1023
HI -point value	HI ALARM POINT SETPOINT:	S1	0.000...+/-9999
HI trip set-point value	HI TRIP POINT SETPOINT:	S2	0.000...+/-9999
LO alarm set-point value	LO ALARM POINT SETPOINT:	S3	0.000...+/-9999
LO trip set-point value	LO TRIP POINT SETPOINT:	S4	0.000...+/-9999
Starting delay of the HI alarm set-point	HI ALARM POINT RESP.TIME	S5	0...255 s
Starting delay of the HI trip set-point and of the rise time alarm	HI TRIP POINT RESP.TIME	S6	0...255 s
Starting delay of the LO alarm set-point	LO ALARM POINT RESP.TIME	S7	0...255 s
Starting delay of the LO trip set-point and of the fall time alarm	LO TRIP POINT RESP.TIME	S8	0...255 s



Type of information	Displayed memo	Bus code	Value
Resetting delay of the HI alarm set-point	HI ALARM POINT RESET TIME	S9	0...255 s
Resetting delay of the HI trip set-point and of the rise time alarm	HI TRIP POINT RESET TIME	S10	0...255 s
Resetting delay of the LO alarm set-point	LO ALARM POINT RESET TIME	S11	0...255 s
Resetting delay of the LO trip set-point and of the fall time alarm	LO TRIP POINT RESET TIME	S12	0...255 s
Grouping of reflash A from HI alarm set-point	HI ALARM POINT RFL A TO RLY	S13	0...6
Grouping of the reflash B from HI alarm set-point	HI ALARM POINT RFL B TO RLY	S14	0...6
Grouping of reflash A from the HI trip and rise time set-point	HI TRIP POINT RFL A TO RLY	S15	0...6
Grouping of reflash B from the HI trip and rise time set-point	HI TRIP POINT RFL B TO RLY	S16	0...6
Grouping of reflash A from LO alarm set-point	LO ALARM POINT RFL A TO RLY	S17	0...6
Grouping of reflash B from LO alarm set-point	LO ALARM POINT	S18	0...6
Grouping of reflash A from LO trip and fall time set-point	LO TRIP POINT RFL A TO RLY	S19	0...6
Grouping of reflash B from LO trip and fall time set-point	LO TRIP POINT RFL B TO RLY	S20	0...6
Rise time set-point	RISE RATE HIGH SET POINT	S21	0 = disconnected 1...100 %/s
Fall time set-point	FALL RATE HIGH SET POINT	S22	0 = disconnected 1...100 %/s
Grouping of channel to average value system	REF.VALUE DEVS INCLUDED?	S23	0 = not included 1 = included
Average value deviation set-point upwards at 83% of the measurement range	REF.VALUE DEVS +DEV 83 %:	S24	0.000...+/-9999
Average value deviation set-point upwards at 33% of the measurement range	REF.VALUE DEVS +DEV 33 %:	S25	0.000...+/-9999

Type of information	Displayed memo	Bus code	Value
Average value deviation set-point downwards at 83% of the measurement range	REF.VALUE DEVS -DEV 83 %:	S26	0.000...+/-9999
Average value deviation set-point downwards at 33% of the measurement range	REF.VALUE DEVS -DEV 33 %:	S27	0.000...+/-9999
The delays and the groupings of the deviation alarms are the same as for the HI alarm set-point			
Blocking function 1, type	INTERLOCKINGS 1:FUNCT.	S28	0 = blocking out 1 = reflash A blocked 2 = whole channel blocked
Blocking function 1, grouping	INTERLOCKINGS 1:GROUP	S29	0 = not grouped 1...4 = grouped
Blocking function 2, type	INTERLOCKINGS 2:FUNCT.	S30	0 = blocking out 1 = reflash A blocked 2 = whole channel blocked
Blocking function 1, grouping	INTERLOCKINGS 2:GROUP	S31	0 = not grouped 1...4 = grouped
Registration of measurement value deviation	DELTA VALUE RECORD, AT	S32	0.000...-/-9999
Scaling, max.value	SCALING 100 %	S33	0.000...+/-9999
Scaling, min.value	SCALING 0 %	S34	0.000...+/-9999
Scaling, 10 %	SCALING 10 %	S35	0.000...+/-9999
Scaling, 20 %	SCALING 20 %	S36	0.000...+/-9999
Scaling, 30 %	SCALING 30 %	S37	0.000...+/-9999
Scaling, 40 %	SCALING 40 %	S38	0.000...+/-9999
Scaling, 50 %	SCALING 50 %	S39	0.000...+/-9999
Scaling, 60 %	SCALING 60 %	S40	0.000...+/-9999
Scaling, 70 %	SCALING 70 %	S41	0.000...+/-9999

Type of information	Displayed memo	Bus code	Value
Scaling, 80 %	SCALING 80 %	S42	0.000...+/-9999
Scaling, 90 %	SCALING 90 %	S43	0.000...+/-9999
Type of scaling	SCALING LINEAR/NONLINEAR	S44	0 = linear 1 = non-linear
Signal filtering	FILTER	S45	0 = 300 ms 1 = 1 s 2 = 5 s
Deadband	DEADBAND	S46	0...100 per mille
Type of transducer	INP.SIGN.SPEC.	S47	0 = contact input 1 = not specified 2 = not specified 3 = 0...5 mA 4 = 1...5 mA 5 = 0...20 mA 6 = 4...20 mA 7 = 0...1 V 8 = 0...5 V 9 = 1...5 V 10 = 0...10 V 11 = 2...10 V 12 = Pt 100, -20...230°C 13 = Pt 100, -20...600°C 14 = Pt 250, -20...230°C 15 = Pt 250, -20...600°C 16 = Pt 1000, -20...230°C 17 = Pt 1000, -20...600°C 18 = adjustable Pt -20...600°C 19 = Ni 100, -13...130°C 20 = Ni 100, -13...250°C 21 = Ni 120, -45...250°C 22 = Ni 250, -13...130°C 23 = Ni 250, -13...250°C 24 = Ni 1000, -13...130°C 25 = Ni 1000, -13...250°C 26 = adjustable Ni -13...250°C 27 = 0...200 Ω 28 = 0...500 Ω 29 = 0...2000 Ω 30 = 0...1000 Ω 31 = 0...2500 Ω 32 = 0...10 kΩ 33 = adjustable potentiometric input (0...130 Ω)... 34 = adjustable potentiometric input (0...640 Ω)... 35 = not specified

Type of information	Displayed memo	Bus code	Value
Channel-specified	IND.SEQUENCE indication	S48	0 = normal alarm sequence 1 = normal alarm sequence with audible ringback 2 = visual indicator function without audible alarm
Measurement quantity	MEASURED QTY	S49	XXXXXX = five freely selectable characters
Channel legend	Channel text	S50	XXXXXXXXXXXX = ten freely selectable characters
Upper limit value of the transducer fault supervision	INP.SUPERVISION HI LIMIT	S51	0.000...+/-9999
Lower limit value of the transducer fault supervision	INP.SUPERVISION LO LIMIT	S52	0.000...+/-9999
Input contact oscillation supervision	INP.OSC.MONITOR	S53	1...255 events/min 0 = disconnected

## Event codes

### Module related codes (channel (0))

HI set-point value of the average value, activation	E1
HI set-point value of the average value, resetting	E2
Blocking set-point for average value, activation	E3
Blocking set-point for average value, resetting	E4
Parameter memory initialization started	E7
Parameter memory initialization executed	E8
Internal annunciator unit fault	E10
Event register overflow	E13
Earth-fault, activation	E22
Earth-fault, resetting	E23

### Channel-specific codes (channels 1.16)

HI alarm set-point, starting	E1
HI alarm set-point, resetting	E2
HI trip set-point, starting	E3
HI trip set-point, resetting	E4
LO alarm set-point, starting	E5
LO alarm set-point, resetting	E6
LO trip set-point, starting	E7
LO trip set-point, resetting	E8
Measurement deviation, registration upwards	E15
Measurement deviation, registration downwards	E16
Out of measuring range upwards, activation	E20
Out of measuring range upwards, resetting	E24
Out of measuring range downwards, activation	E21
Out of measuring range downwards, resetting	E25
Tripping of input contact oscillation supervision	E23

**Technical data****Annunciator channels**

Number of channels per annunciator unit	16
Selectable transducer signal types	0...5 mA, 1...5 mA, 0...20 mA, 4...20 mA 0...1 V, 0...5 V, 1...5 V, 0...10 V, 2...10 V, Pt 100, Pt 250, Pt 1000 Ni 100, Ni 120, Ni 250, Ni 1000 One selectable Pt or Ni signal within the range 65...1000 $\Omega$ , potentiometric signal within the range 0...200 $\Omega$ , 0...500 $\Omega$ , 0...1 k $\Omega$ , 0...2 k $\Omega$ , 0...2.5 k $\Omega$ , 0...10 k $\Omega$ , contact function
Scaling types	Linear or non-linear
Signal filtering, selectable time bases for 0...90 % step response	0.3 s, 1 s or 5 s
Set-point values per channel	Two HI and two LO set-points or one HI and one LO plus one rise time and one fall time set-point
Channel starting delay at set-point value transition	0...255 s
Channel resetting delay at set-point value resetting	0...255 s
Deadband setting range, on a per channel basis	0...100 per mille
Measuring accuracy	0.5 % of scale range
Transducer supply	24 V dc $\pm$ 10 %, max. 320 mA
Transducer supervision, measuring range	Fully selectable upper and lower transducer signal limit values
Transducer circuit earth-fault supervision	Integrated with a sensitivity of 5...10 k $\Omega$
Transducer oscillation supervision	Selectable 1...255 events/s. Can even be set out of function
Reference channel function	Any channel may be assigned reference channel. The reference value may also be the average value of the measurement value of channels 2...16
Reference value deviation set-point values	Two selectable set-point values, one upper and one lower, separately given at 33 % and 83 % of the measuring range. Between these given set-point values the set-point values are interpolated and outside the given set-point values the set-point values are extrapolated from the given set-point values
Registration of measurement value alteration	Selectable setting value of the size of alteration which will be stored as an event in the event sequence register

### Realarm function

Permanent groupable realarm output relays	Six relays with one NO contact per relay. The contacts may be given NC function by means of jumpers
Audible alarm output	One relay with one NO contact (NC contact by jumper)
Self-supervision system output	One relay with one NO contact (NC by jumper)
Relay contact rated current/max. breaking current	3A/250 V ac or dc

### External control inputs

Audible alarm reset	NO circuit
Alarm acknowledge	NO circuit
Alarm channel reset	NO circuit
Remote testing	NO circuit
Control of unit into LOCAL mode	NO circuit
Control of unit into REMOTE mode	NO circuit
Clock synchronization contact loop supply	NO circuit, pulse length > 100 ms, 48 V dc, 4 mA

### Serial communication

Data bus type	SPA bus, serial (LON bus by LON/SPA Gateway, SPA-ZC 100)
Selectable connections	Glass or plastic fibre, RS 485, RS 232. Bus connection modules on request.
Data transfer rate, selectable values	9600 Bd, 4800 Bd, 2400 Bd, 1200 Bd or 300 Bd
Communication protocol	SPA protocol, an ASCII protocol open for all users

### Auxiliary power supply

Standard supply unit input voltage range	80...265 V ac/dc
Optional supply unit input voltage range, not intended for use with double supply	18...80 V dc
Power demand from auxiliary source, max./min. value	~20 W/~30 W

## Test voltages

Channel and control inputs versus annunciator case, supply inputs and relay outputs

Dielectric test voltage as per IEC 255-5 and SS 436 15 03 500 V, 50 Hz, 1 min

Impulse test voltage as per IEC 255-5 and SS 436 15 03 1 kV, 1.2/50  $\mu$ s, 0.5 J

High frequency test voltage as per IEC 255-5 and SS 436 15 03 1 kV, 1 MHz

Spark interference test voltage as per SS 436 15 03 2...4 kV

Supply inputs versus case, relay outputs versus case, supply inputs and relay outputs between themselves

Dielectric test voltage as per IEC 255-5 and SS 436 15 03 2 kV, 50 Hz, 1 min

Impulse test voltage as per IEC 255-5 and SS 436 15 03 5 kV, 1.2/50  $\mu$ s, 0.5 J

High frequency test voltage as per IEC 255-5 and SS 436 15 03 2.5 kV, 1 MHz

Spark interference test voltage as per SS 436 15 03 4...8 kV

## Environmental conditions

Ambient service temperature range – including matrix display –10°C...+55°C  
–10°C...+45°C

Ambient transport and storage temperature range –20°C...+55°C

Long term heat/damp as per IEC 68-2-3 <95 % at 40°C for 56 days/year

Degree of protection by enclosure, when panel mounted IP 54

Mass of the annunciator unit ~4.5 kg (~10 lb)

## Testing

The annunciator unit is provided with a sophisticated, built-in self-supervision system which monitors the internal voltages of the unit and supervises the function of the microprocessor and the logic circuits. Further, the annunciator may be programmed to provide earth-fault protection, short-circuit protection and conductor discontinuity protection of the transducer circuits.

Upon detection of a permanent internal fault, the output contact of the self-supervision system closes and the FAULT indicator on the front panel is illuminated.

A transducer fault is indicated with a letter F and the channel number in the digital display. An earth-fault is indicated with the letters EF. The earth-fault can not be reset before the fault has disappeared. At a transducer fault the output relay contact of the self-supervision system closes but the FAULT-indicator remains off.

Starting from the basic display the annunciator unit may be tested by first pushing the SET push-button and then the TEST push-button. The test program then goes through all the units indicators. After the test sequence the desired display is selected again.

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## Maintenance and repair

When the annunciator unit is used under the conditions specified in the section "Technical data", no regular maintenance is needed. The annunciator unit holds no parts or component subject to wear and tear under normal operating conditions.

If the environmental conditions at the annunciator operating site differ from those specified, as to ambient temperature, humidity or if the atmosphere around the annunciator holds chemically active gases or dust, the annunciator unit ought to be visually inspected as a routine measure taken as part of the condition monitoring of the installation. Especially the following things must be observed.

- mechanical damage on the case, the fastening details, the front cover and its gasket, the plug-in modules and their connection sockets
- signs of starting corrosion on the PC boards, component legs and cups, bolts and nuts or other metallic parts

- signs of accumulation of dust or dirt inside the cover, on PC boards or in the case. The reason may be a faulty gasket in the front cover.

In most cases an operational malfunction may be rectified by changing a plug-in module, see spares below. When the microprocessor module SWPM 4A1 is changed to a new one, the program memory of the old module may be moved to the new one. In this way the new module needs not to be set and configured from the beginning. The parameter memory is marked D6 and it is located in the lower left corner of the plug-in module. When plugging in the memory circuit, check carefully that the circuit is inserted in the correct position. The slot in one end of the IC circuit end is to be turned in the same direction as on the other ICs of the PC board. In this way possible damage of the memory circuit can be avoided.

If the circuit malfunction proves unrepairable, it is recommended that the supplier or manufacturer are contacted for further information on service and repair measures to be taken.



**Accessories and spare parts**

Microprocessor module	SWPM 4A1
Analogue input module	SWAM 16A1
Digital input/output module	SWOM 8A1
Display module	SWDM 4A1
Connection module (the whole rear module)	SWCM 13A1
Connection module (permanent transducer connection)	SWCM 10A1
Connection module (detachable transducer connection)	SWCM 10A2
Auxiliary supply module	
–input voltage range 80...265 V ac/dc	SPGU 240A1
–input voltage range 18...80 V dc	SPGU 48B2
Spare legend text sheet, three text foils	SYKU 639
Raising frame, 40 mm	SPA-ZX 301
Raising frame, 80 mm	SPA-ZX 302
Raising frame, 120 mm	SPA-ZX 303
Bus connection module, plastic fibre out, plastic fibre in	SPA-ZC21 BB/S
Bus connection module, glass fibre out, glass fibre in	SPA-ZC21 MM/S
Bus connection module, plastic fibre out, glass fibre in	SPA-ZC21 BM/S
Bus connection module, glass fibre out, plastic fibre in	SPA-ZC21 MB/S
Bus connection module, plastic fibre out, plastic fibre in	SPA-ZC17 BB/S
Bus connection module, glass fibre out, glass fibre in	SPA-ZC17 MM/S
Bus connection module, plastic fibre out, glass fibre in	SPA-ZC17 BM/S
Bus connection module, glass fibre out, plastic fibre in	SPA-ZC17 MB/S
Bus connection module, RS 485	SPA-ZC3
Bus connection module, RS 232/RS485	SPA-ZC4







**ABB Oy**

Substation Automation  
P.O.Box 699  
FIN-65101 VAASA  
Finland  
Tel. +358 (0)10 22 11  
Fax.+358 (0)10 22 41094  
[www.abb.com/substationautomation](http://www.abb.com/substationautomation)