Protection
and control

Sepam range
Sepam 1000
Use
Commissioning

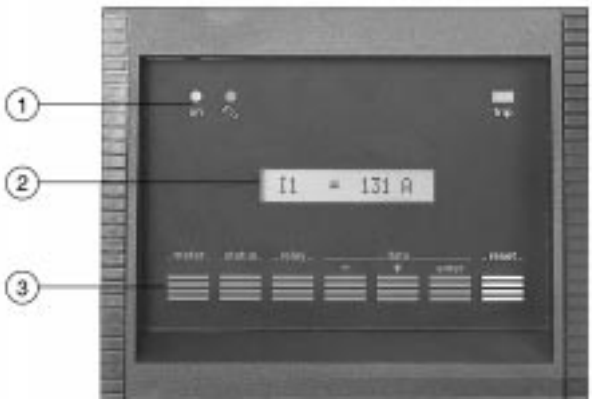
GROUPE SCHNEIDER

■ Merlin Gerin ■ Square D ■ Telemecanique

contents

Your Sepam 1000 is a multifunction, microprocessor-based device which includes in the same case:
■ protection of the network and the loads it supplies.
■ control and monitoring of the associated circuit breaker or contactor,
■ measurement of electrical variables,
■ display of operating messages.

front of device



Status indicators (1)**:**

■ green **on** indicator lamp shows that Sepam 1000 is energized,
■ red **trip** indicator lamp: Sepam has tripped the circuit breaker after detecting a fault. A related alarm message indicates the cause of tripping,
■ red 🔧 indicator shows internal Sepam faults. All the output relays are dropped out (fail-safe position). Refer to the chapter on maintenance.

Display (2)**:**

The display unit indicates:
■ measurements,
■ settings,
■ messages.

Keyboard (3)**:**

The 7-key keyboard is used to:
■ enter the different variables that the user wishes to display,
■ set or modify parameters.

access to measurements and parameters

The measurements and parameters may be accessed via the **meter**, **status** and **relay** keys. They are arranged in loops as shown in the diagram opposite.

■ the data items are divided by category into three loops, linked with the three function keys **meter**, **status** and **relay**:

□ **meter** key: measurements

□ **status** key: general parameters

□ **relay** key: protection parameters

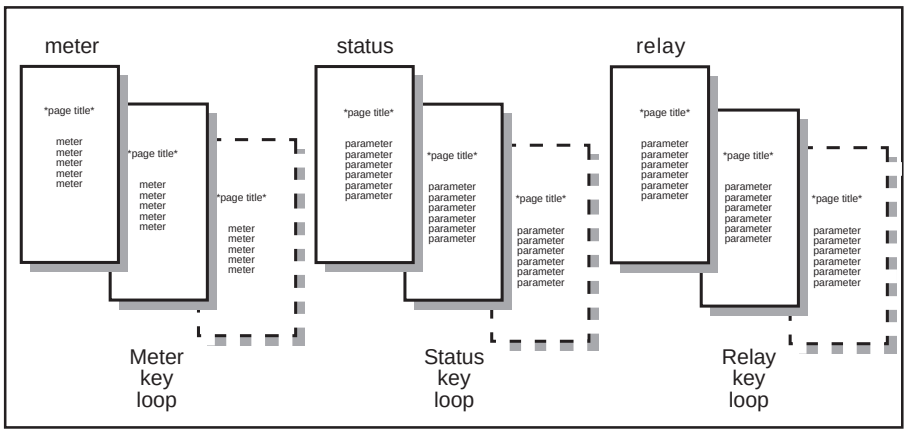
■ each loop is divided into pages. A page includes a lower-case title, which may be identified by the two asterisks which surround it.

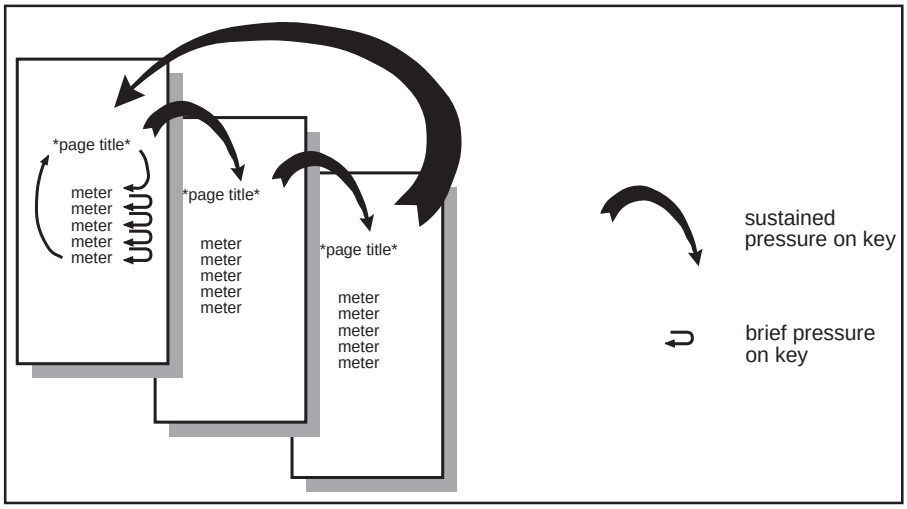
e.g. *Ammeter*

■ to move about within a loop, the user simply presses the corresponding key: **meter**, **status** or **relay**

□ brief pressure is used to scroll through the current page

□ sustained pressure, for more than a second, is used to go on to another page.

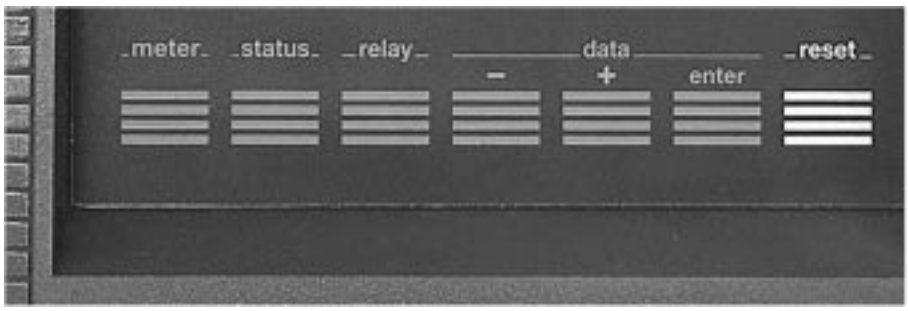




parameter setting mode

This is the mode that is used to set Sepam parameters.

■ the parameter setting mode activiates the **data-**, **data+** and **enter** keys that are used to set the parameters.
■ to switch to parameter setting mode, the user presses the **P** (1) key on the back of Sepam. This key may be accessed using the tip of a pen.
■ to exit parameter setting, the user may:
□ manually press the **P** (1) key on the back of Sepam again,
□ exit automatically if no keys have been pressed for 2 minutes.
■ the parameter setting mode may be identified on the display unit by a **P** as the first character on the right.



Parameter setting

■ switch to parameter setting mode by pressing the **P** key on the rear of Sepam for one second,
■ select the parameter to be set using the appropriate key (**status** or **relay**),
■ use the **data-** and **data+** keys to scroll the possible settings until the required value is reached,
■ press the **enter** key to store the new parameter value.
Parameter setting is complete.
Any parameter values that have not been stored will blink on the display. Ensure that the parameter is displayed steadily after the **enter** key is pressed.
Whenever Sepam detects a setting problem, a **CHECK SETTINGS** message appears on the display. Refer to the section entitled **CHECK SETTINGS** (p. 16).

example of display:

I1	=	0.0 A	P
In	=	100 A	P
In	=	**"150 A"**	P
In	=	150 A	P

CHECK SETTINGS

messages

Sepam displays 4 types of messages, listed below in order of priority:
- measurement and parameter display
- **CHECK SETTINGS** parameter setting message
- alarm messages
- trip messages

Measurement and parameter display is controlled via the keyboard.

The parameter setting message **CHECK SETTINGS** is displayed by the system in specific parameter setting situations (refer to **CHECK SETTINGS** section on p. 16).
Alarm messages are displayed by the protections whenever an operating set point is overrun. These messages allow for simple activation of the protective relays.
Trip messages are transmitted by the protections when they trip. Trip messages blink on the display. They may be latched-in type messages.

- priority management rules:
  - higher priority messages replace lower priority messages on the display.
  - pressing a key will redisplay measurements and parameters for 20 seconds.

Alarm messages

An alarm message appears on the display whenever a protection's operating set point is overrun. Alarm messages are displayed steadily and are cleared at the same time as the related faults. When more than one type of fault occurs at the same time, only the last fault to occur will trigger an alarm message.

alarm message (steady display)	meaning
PHASE FAULT	phase current is above set point
Io FAULT	earth fault current is above set point
UNBALANCE	negative sequence current is above set point
THERMAL ALARM	heat rise is above alarm set point
UNDERCURRENT	phase current is below set point
START INHIBIT.	starts per hour protection prohibits all starts
OVERVOLTAGE	voltage is above set point
Vo FAULT	residual voltage is above set point
UNDERVOLTAGE	voltage is below set point
UNDERFREQ.	frequency is below set point
OVERFREQ.	frequency is above set point

Trip messages

A trip message, indicated the type of fault, appears on the display whenever a protection trips.
Sepam stores all the trip messages transmitted consecutively during operation. The user may obtain a readout of the stored messages by pressing the **reset** key (refer to **acknowledgement** further on in the document).
Trip messages are always of the latched-in type when transmitted by a protection which controls the TRIP output relay (tripping relay). They are also of the latched-in type when transmitted by a protection which controls one or more auxiliary lockout relays. Otherwise, they are not of the latched-in type. Latched-in messages are saved if a power failure occurs.

trip message (blinking display)	meaning
PHASE FAULT	phase overcurrent protection tripped
Io FAULT	earth fault protection tripped
UNBALANCE	negative sequence overcurrent protection tripped
THERMAL TRIP	thermal protection tripped
LONG START	excessive starting time protection tripped
LOCKED ROTOR	locked rotor protection tripped
UNDERCURRENT	undercurrent protection tripped
OVERVOLTAGE	overvoltage protection tripped (set point 2)
Vo FAULT	one of neutral voltage displacement protections tripped
UNDERVOLTAGE	one of undervoltage protections tripped
UNDERFREQ.	underfrequency protection tripped
OVERFREQ.	overfrequency protection tripped

TRIP indicator

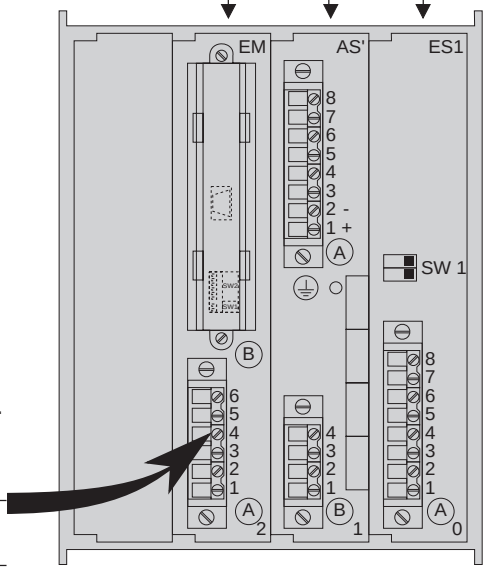
The TRIP indicator blinks to report that a circuit breaker tripping order has been transmitted by a protective relay as a result of a mains fault. The TRIP indicator is of the latching type. It only switches off after the protections have been acknowledged.

Sepam 1000 components

slot 0
optional 1 input / 3 output board (ES1)

slot 1
2 output power supply module (AS')

slot 2
analog input module
□ current measured by CT (EM);
□ current measured by CSP sensor (EA);
□ voltage (ET).



terminal identification system

All the Sepam 1000 connection terminals are located on the rear of the device.
The Sepam 1000 modules are installed in slots numbered 0 to 2.
Connections are identified by markings.
Slot (0 to 2),
connector A or B, terminal (1 to 8).

Example: 2 A 4
slot n°2, connector A, terminal 4.

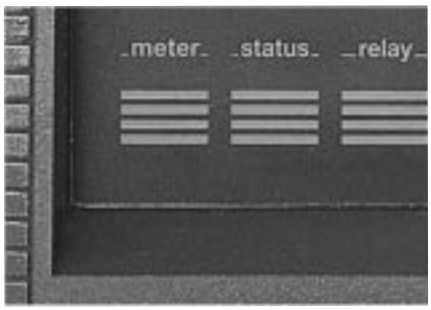
energizing

When re-energized after a break in the auxiliary power supply, Sepam 1000 automatically restarts according to the following sequence which lasts about 4 seconds:
- green **on** and red 🔧 indicators light up,
- extinction of red 🔧 indicator,
- resetting of watchdog contact,
- display of the first message (version name followed by version number). Sepam is then in operation.

Sepam 1000 performs the functions of a precision measurement and alarm processing unit.
The values are displayed directly with the related unit A, kA, etc. The messages are clearly worded.

The device is operated via the front, by using the 7 keys on the keyboard:
- **meter**: access to measurements
- **status**: access to general parameters
- **relay**: access to protection parameters
- **data-**, **data+** and **enter**: setting keys (activated in **P** mode only)
- **reset**: acknowledgement, trip message readout, resetting to zero.

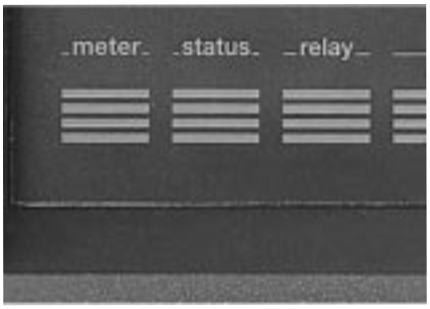
meter key



The **meter** key is used to display the values measured by Sepam.

name	function	range	accuracy	remarks
meter key / *Ammeter* page				
I1 I2 I3	measurement of each phase current	0.05 to 24In	±5% or ±0.03In	
IM1 IM2 IM3	measurement of the greatest average phase current for each phase	0.05 to 24In	±5% or ±0.03In	RESET: **reset** key value calculated every 5 mn
meter key / *I trip* page				
TRIP1 TRIP2 TRIP3	measurement of phase and earth currents at the time of the last tripping order (activation of TRIP relay)	0.05 to 24In	±5% or ±0.03In	no RESET
TRIPo		0.02 to 10Ino	±5% or ±0.02Ino or ±0.1 A	
meter key/ *Other data* page				
E	heat rise (thermal overload)	0 to 200%		
Ii	negative sequence current	10 to 500%Ib	±5% or ±0.02In	
CH	running hours counter	0 to 99999h	±1% or ±0.5h	RESET: **reset** key in parameter setting mode ■ the counter value is saved in non volative storage every 24 h
N or Tsi	number of starts before lockout or waiting period before restarting allowed	1 to 60/h 1 to 60 mn		
Vd	measurement of positive sequence voltage	0.025 to 1.5 Vnp	±5% or ±0.005Vnp	
OUTPUT	logic output status	0 or 1		2 or 5 digit code
INPUT	logic input status (when ES1 option is included)	0 or 1		
meter key / *V/Hz meter* page				
U21 U32 U13	measurement of phase-to-phase voltages	0.015 to 1.5Unp	±3% or ±0.005Unp	U21 and U32 are measured U13 is calculated
F	measurement of frequency	50 ±5 Hz 60 ±5 Hz	±0.05 Hz	measured on voltages U21 and U32

status key

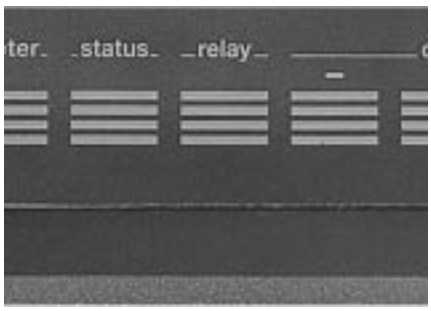


The **status** key is used to display Sepam general parameter settings. The characters indicated via this key give the characteristics of the equipment being protected and of the cubicle (***Device*** page). They also define Sepam input/output operation (***Input/ output*** page).

name	function	setting range	remarks
status key/ *Device* page			
SEPAM XXX	information on the type of Sepam		This message appears, with the version number, when the device is energized.
In	CT primary rated current or CSP sensor rated setting	50 values between 10 A and 6.25 kA	
Ino	CSH core balance CT input rating or standard core balance CT primary current rating	■ sum of 3I (3I) ■ 2A or 30A core bal. CT ■ 56 values between 1 A and 6.25 kA	
Ib	motor or transformer basis current	0.4 to 1.3In in amps	
Unp	VT primary rated current	220 V to 250 kV	
Uns	VT secondary rated current	100, 110, 115, 120 V	
Vnso	type of residual voltage measurement	■ sum of 3V (3V) ■ Uns/$\sqrt{3}$ ■ Uns/3	
VT's	voltages measured by VTs	■ U21 ■ U21 U32	
Fn	network frequency rating	50 or 60 Hz	

name	function	setting range	remarks
status key / *Input/output* page			
LATCH	latching of output relays	32 logic combinations from 00000 to 11111	
PS	output relay program logic (positive contact indication)		
I>→	addressing of three-phase overcurrent protection low set		
I>>→	addressing of three-phase overcurrent protection high set		
Io>→	addressing of earth fault protection low set		
Io>>→	addressing of earth fault protection high set		
START→	addressing of logic discrimination output		
E>→	addressing of thermal protection tripping output		
ALARM→	addressing of thermal protection alarm output		
Ii>→	addressing of negative sequence current protection output		
LSLR→	addressing of excessive starting time / locked rotor protection tripping output		
INHIB→	addressing of inhibit start order		
I<→	addressing of undercurrent protection output		
U>→	addressing of phase-to-phase overvoltage protection set point 1 output		
U>>→	addressing of phase-to-phase overvoltage protection set point 2 output		
U<→	addressing of phase-to-phase undervoltage protection set point 1 output		
U<<→	addressing of phase-to-phase undervoltage protection set point 2 output		
Vd<→	addressing of positive sequence undervoltage protection set point 1 output		
Vd<<→	addressing of positive sequence undervoltage protection set point 2 output		
Ur<→	addressing of remanent undervoltage protection output		
Vo>→	addressing of neutral voltage displacement protection set point 1 output		
Vo>>→	addressing of neutral voltage displacement protection set point 2 output		
F>→	addressing of overfrequency protection output		
F<→	addresing of underfrequency protection set point 1 output		
F<<→	addressing of underfrequency protection set point 2 output		
WDG→	addressing of watchdog information		
INP1	selection of logic input 1 function	■ STATUS: status readout ■ BLOCK: blocking ■ RESET: acknowledgement ■ TRIP: tripping	Sepam S01 and T01 only
TEST	output relay test	TRIP, AUX1, AUX2, AUX3, AUX4	

relay key



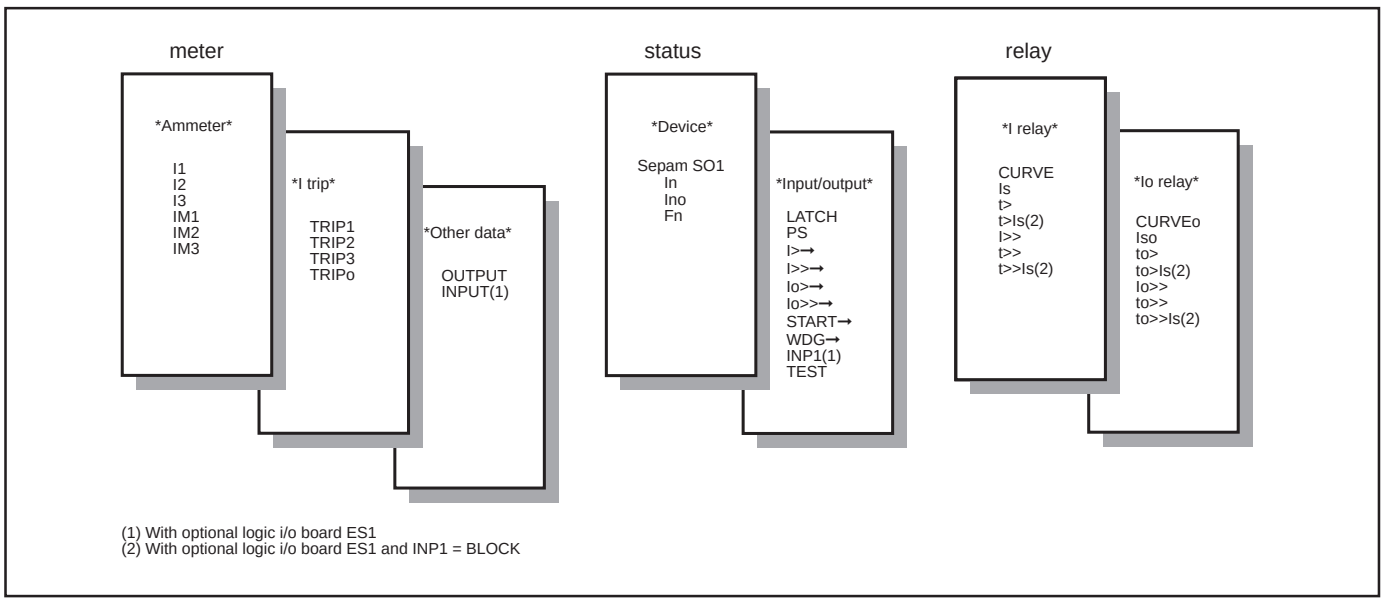
The **relay** key is used to display the protection parameter settings.

name	protection	parameter	setting range	remarks
relay key / *I relay* page				
CURVE	three-phase overcurrent	selection of low set unit curve	DT, SIT, VIT, EIT, UIT, RI	
Is		low set unit setting current	DT: 0.3 to 8In SIT, VIT, EIT, UIT, RI: 0.3 to 2,4In	inhibition: 999 kA
t>		low set unit time delay	DT: 100 ms to 90 s SIT, VIT, EIT, UIT, RI: 100 ms to 12.5 s	
t>Is		low set unit logic discrimination time delay (Is : logic selectivity)	DT: 100 ms to 90 s SIT, VIT, EIT, UIT, RI: 100 ms to 12.5 s	if logic input used for blocking
I>>		high set	1 to 24In	inhibition : 999 kA
t>>		high set unit time delay	25 ms to 2 s	
t>>Is		high set unit logic discrimination time delay (Is : logic selectivity)	50 ms to 2 s	if logic input used for blocking
relay key / *Io relay* page				
CURVEo	earth fault current	selection of low set unit curve	DT, SIT, VIT, EIT, UIT, RI	
Iso		low set unit setting current	DT with: Sum 3I: 0.05 to 2In 2A core bal. CT: 0.1 to 4 A 30A core bal. CT: 1.5 to 60 A 1A/5ACT: 0.05 to 2Ino SIT, VIT, EIT, UIT, RI with: Sum 3I: 0.05 to 1In 2A core bal. CT: 0.1 to 2 A 30A core bal. CT: 1.5 to 30 A 1A/5ACT: 0.05 to 1Ino	inhibition: 999 kA
to>		low set unit time delay	DT: 100 ms to 90 s SIT, VIT, EIT, UIT, RI: 100 ms to 12,5 s	
to>Is		low set unit logic discrimination time delay (Is : logic selectivity)	DT: 100 ms to 90 s SIT, VIT, EIT, UIT, RI: 100 ms to 12,5 s	if logic input used for blocking
Io>>		high set	Sum 3I: 0.05 to 10In 2A core bal. CT: 0.1 to 20 A 30A core bal. CT: 1.5 to 300 A 1A/5A CT: 0.05 to 10Ino	inhibition: 999 kA
to>>		high set unit time delay	25 ms to 2 s	
t>>Is		high set unit logic discrimination time delay (Is : logic selectivity)	50 ms to 2 s	if logic input used for blocking
relay key / *Therm. relay* page				
T1	thermal overload	heat rise time constant	5 to 120 mn	
T2		cooling time constant	5 to 600 mn	Sepam M01 and M02
E>		tripping set point	50 to 200%	inhibition: 999%
E<		authorized start set point	50 to 200%	

name	protection	parameter	setting range	remarks
relay key / *Other relays* page				
Ii>	negative sequence current	protection set point	20 to 50%Ib	
ST	excessive starting time	motor start time delay	0.5 s to 300 s	inhibition: 999 s
LT	locked rotor	locked rotor time delay	0.5 s to 60 s	
N1 N2	starts/hour	total number of starts allowed number of consecutive starts allowed	1 to 60 1 to 60	inhibition: 999
I<	under-current	protection set point	20 to 100%Ib	Inhibition: 999%Ib
t<		tripping time delay	1 to 10 s	
relay key / *U> relays* page				
U> tu> U>> tu>>	phase-to-phase overvoltage	set point 1 set point 1 time delay set point 2 set point 2 time delay	0.5 to 1 Unp 0.1 to 90 s 0.5 to 1 Unp 0.1 to 90 s	inhibition: 999 kV inhibition: 999 kV
relay key / *U< relays* page				
U< tu< U<< tu<<	phase-to-phase undervoltage	set point 1 set point 1 time delay set point 2 set point 2 time delay	0.05 to 1 Unp 0.1 to 90 s 0.05 to 1 Unp 0.1 to 90 s	inhibition: 999 kV inhibition: 999 kV
Vd< tvd< Vd<< tvd<<	positive sequence undervoltage	set point 1 set point 1 time delay set point 2 set point 2 time delay	0.3 to 1 Vnp 0.1 to 90 s 0.3 to 1 Vnp 0.1 to 90 s	inhibition: 999 kV inhibition: 999 kV
Ur<	remanent undervoltage	set point time delay	0.05 to 1 Unp 0.1s	inihibition: 999 kV fixe value
relay key / *Vo relay* page				
Vo> tvo> Vo>> tvo>>	neutral voltage displacement	set point 1 set point 1 time delay set point 2 set point 2 time delay	0.05 to 0.8 Unp 0.1 to 90 s 0.05 to 0.8 Unp 0.1 to 90s	inhibition: 999 kV inhibition: 999 kV
relay key / *Freq. relay* page				
F> tf>	over-frequency	set point time delay	50 to 53 Hz or 60 to 63 Hz 0.1 to 90 s	inhibition: 999 Hz
F< tf< F<< tf<<	under-frequency	set point 1 set point 1 time delay set point 2 set point 2 time delay	48 to 50 Hz or 58 to 60 Hz 0.1 to 90 s 45 to 48 Hz or 55 to 58 Hz 0.1 to 90 s	inhibition: 999 Hz inhibition: 999 Hz

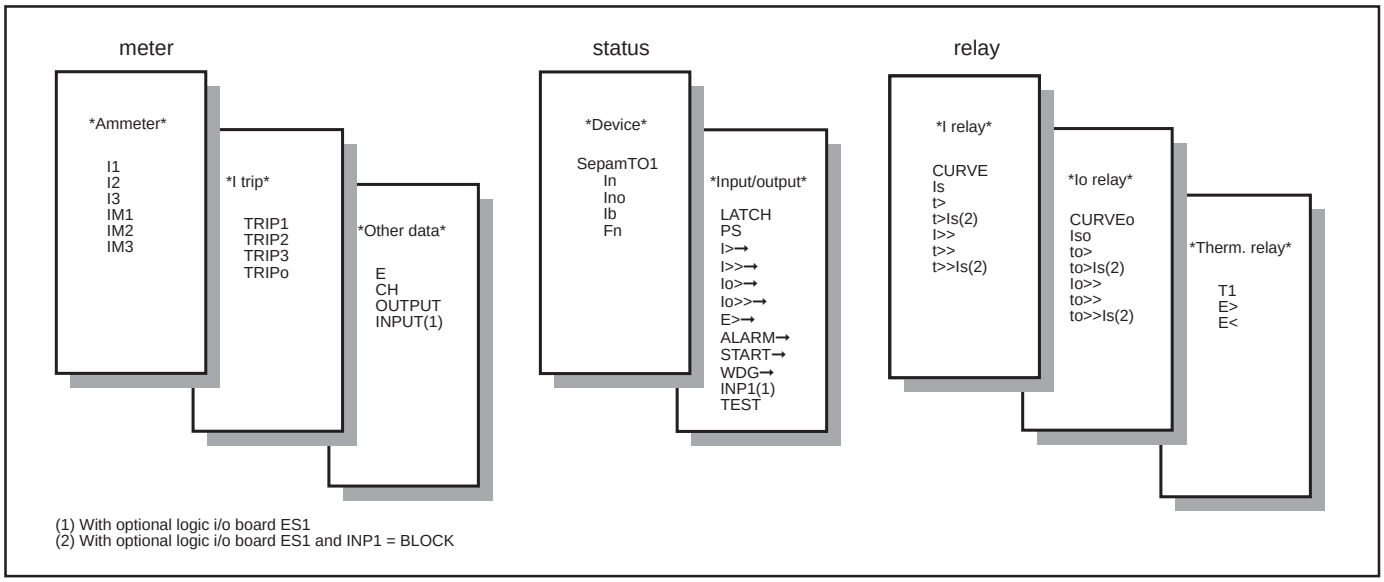
loop arrangement of measurements and parameters

Sepam 1000 S01



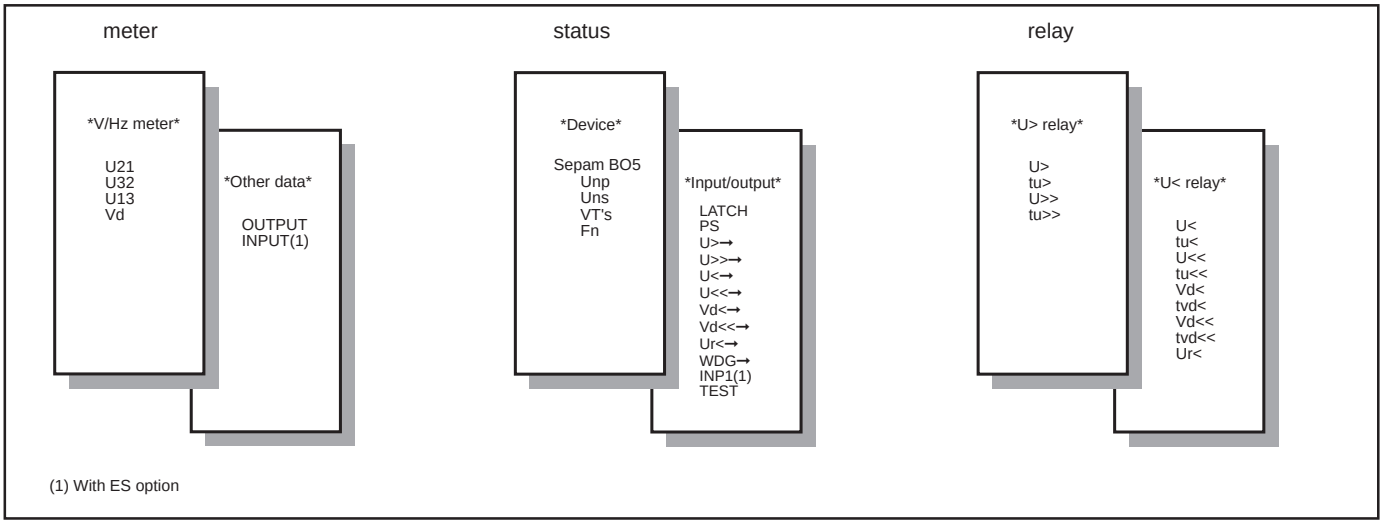
(1) With optional logic i/o board ES1
(2) With optional logic i/o board ES1 and INP1 = BLOCK

Sepam 1000 T01

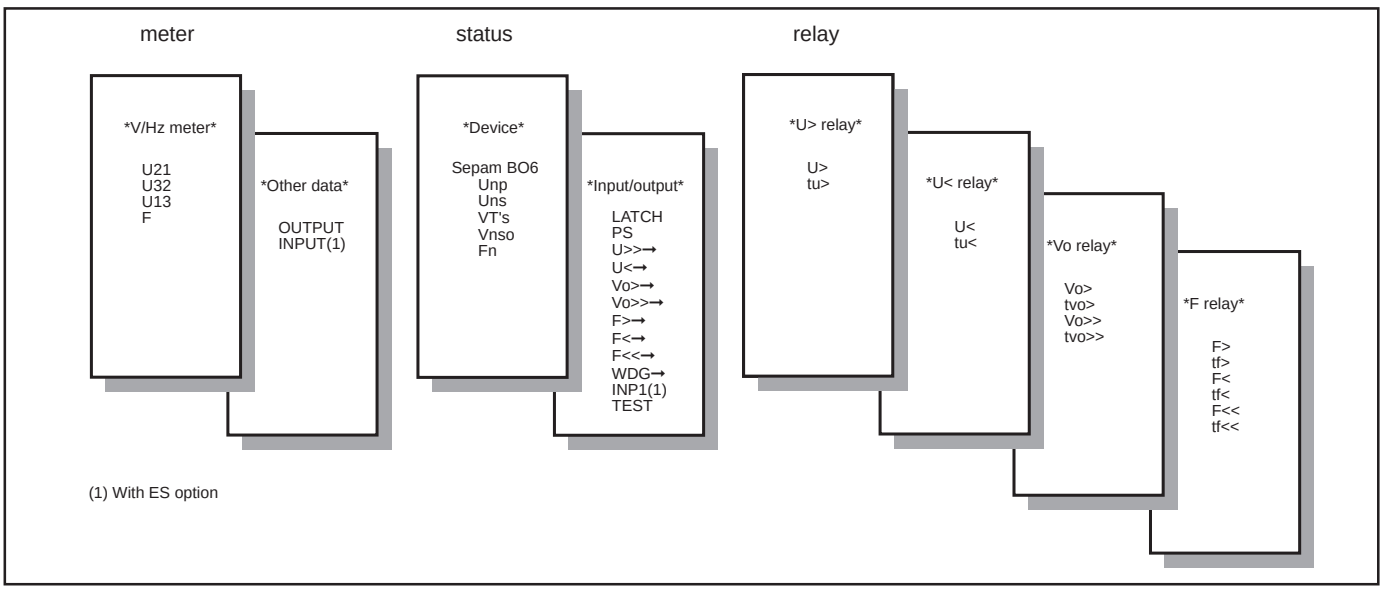


(1) With optional logic i/o board ES1
(2) With optional logic i/o board ES1 and INP1 = BLOCK

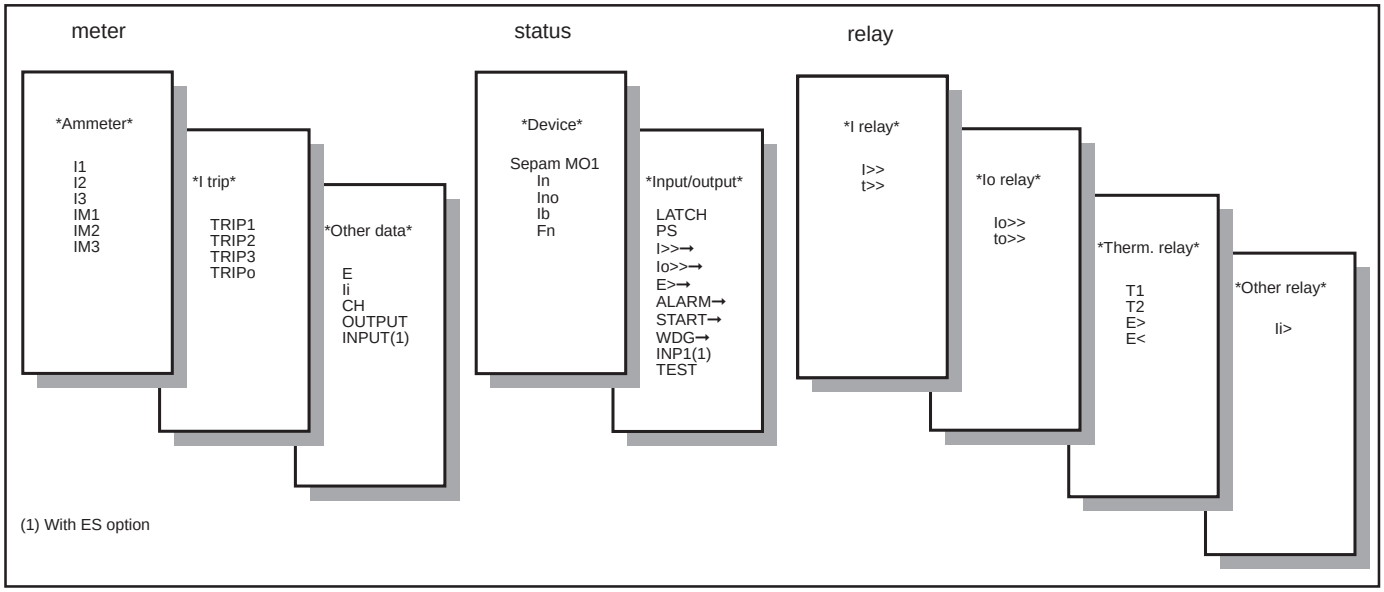
Sepam 1000 B05



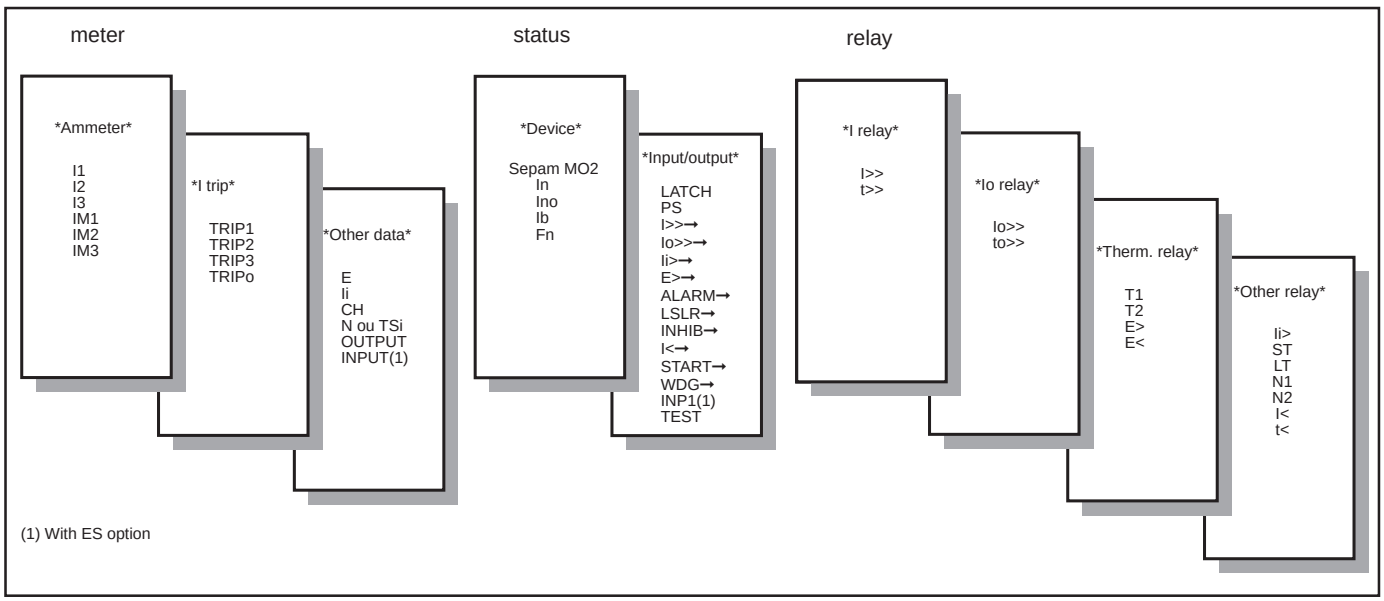
Sepam 1000 B06



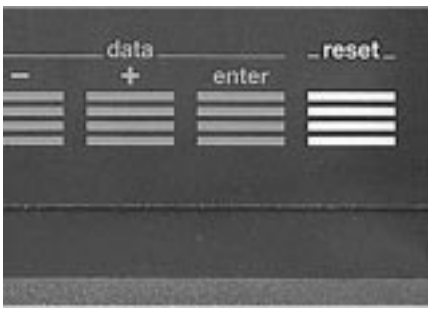
Sepam 1000 M01



Sepam 1000 M02



reset key



The **reset** key is used to:
- acknowledge protections,
- reset the maximum demands to zero,
- reset the running hours counter to zero.

Protection acknowledgement

Pressing the **reset** key has two effects:
- consecutive display of the different stored tripping messages,
- acknowledgement of the protection for which the message is displayed.

It is only possible to acknowledge protections when the fault at the origin of tripping has disappeared.

Acknowledgement results in the dropping out of the tripping order transmitted by the protective relay to control the output relays, the TRIP indicator and the message on the display.

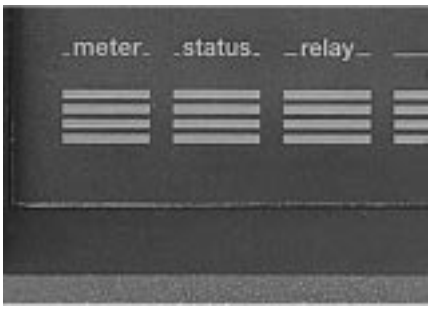
Reset to zero of maximum demands

The **reset** key is used to simultaneously reset the maximum demands to zero when one of the three is displayed.

Reset to zero of running hours counter

In the parameter setting mode, the **reset** key is used to reset the running hours counter to zero when it is displayed.

lamp test



Indicator lamp and display unit operation may be checked by pressing the **meter** and **status** keys at the same time.

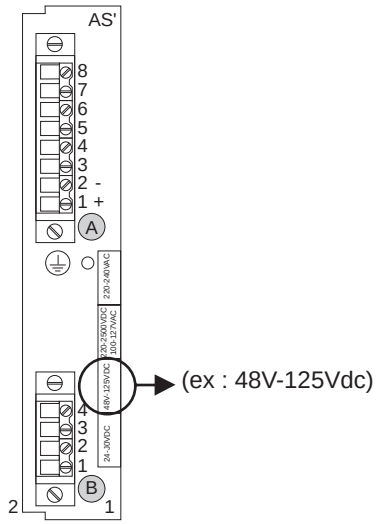
The indicators and the display unit light up while the keys are being pressed.

checking prior to commissioning

These operations must be carried out before Sepam 1000 is energized.

Checks:

■ supply voltage
Ensure that the cubicle auxiliairy supply voltage matches Sepam 1000's operating voltage. It is indicated on the rear of the device, beside the power supply connector, by a dot in the voltage box,



■ earthing
Check that the Sepam 1000 chassis is eearthed via the ground nut situated on the Sepam side panel, on the power supply side. Check that the screw has been tightened.
■ connector
check that all the connectiors on the rear of the device have been plugged in correctly and that they have been screw-locked.
■ Check that the microswitches which define a part of the Sepam operating modes and calibrations were set correctly at the time of installation (1). The settings are given on page 17.
□ CSP sensor current input,
□ 1A or 5A CT current sensor inputs,
□ residual current input,
□ voltage inputs,
□ logic input.

■ The microswitches must be set without Sepam being energized.
■ If the microswitches are not set correctly, the measurement given by Sepam 1000 will be erroneous and the protective relays will not trip at the desired set points.

Default parameter setting

Factory-set parameter status:
■ microswitches:
□ they are set for power supply via a 5A secondary current transformer,
□ residual current measurement by the core balance CT,
□ residual voltage measurement by the sum of the 3 voltages,
■ protections: inhibited
■ program logic:
□ latching TRIP relay
□ no positive contact indication
□ addressing of output information
- circuit breaker tripped: TRIP relay
- watchdog: AUX1 relay
- indication / logic discrimination output: AUX2, AUX3, AUX4

commissioning

Checking mode

All information may be accessed for checking purposes without any risk of modifying parameters or settings.

Parameter setting mode (1)

This mode is reserved for commissioning and maintenance. It requires access to the **P** key on the rear of Sepam.
A **P** appears on the right-hand side of the screen (2).

CHECK SETTINGS message

Modification of one parameter may, in some cases, bring about the automatic modification of another parameter, or create incompatible settings. In such cases, the **CHECK SETTINGS** message is displayed.
This message prompts the user to check the parameters concerned, which are indicated by blinking on the display unit. The user simply sets them to the desired value and they stop blinking. When all setting problems have disappeared, the **CHECK SETTINGS** message disappears.

A few cases in which **CHECK SETTINGS** appears:
■ changing the In setting results in modification of the Ib and possibly Is, I>> settings. This is linked to the fact that the values of the latter depend on In. **CHECK SETTINGS** appears to warn the user regarding unwanted setting changes.
■ settings outside the range: it may happen that some parameters are outsdie the setting range. In such cases, Sepam chooses the closest permissible setting and indicates this choice by the message **CHECK SETTINGS**.
■ incoherent settings
example: the setting **VT's = U21** is incompatible with **Vnso = 3U**. Sepam indicates this incoherency by the message **CHECK SETTINGS**.

Advice
To avoid receiving the **CHECK SETTINGS** message, it is recommended to set the parameters in the following order:
■ the parameters in the **status** loop before those in the **relay** loop,
■ within a page, set the parameters in the order in which they appear after the page title.

(1) All parameters and settings must be in accordance with a network discrimination study which is to be carried out prior to commissioning.
(2) This mode is automatically cancelled by pressing the **P** key if no keys are pressed for a period of about 2 minutes.

Microswitch setting

The microswitches should be set in accordance with the general parameter setting in the **status** loop:

■ current input for 1 A / 5 A CT current sensor
□ 5 A secondary


SW2

□ 5 A secondary


SW2

■ current input for CSP sensor

gamme de courant du capteur CSP	courant nominal du réseau										
30-300A	30	36	45	60	75	90	120	150	180	225	300
200-600A/ 500-1600A	160	192	240	320	400	480	640	800	960	1200	1600
1250-2500A	500	600	750	1000	1250	1500	2000	2500			
SW2	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1

■ residual current input
□ residual current measurement by sum of 3 currents


SW1

□ residual current measurement by core balance CT


SW1

■ logic input

	0 status guarant.	**1 status guarant.**	
0 1  SW1	6.0 Vdc 4.2 Vac	14.0 Vdc 100.0 Vac	setting to be used for supply voltage of 24 to 30 Vdc
0 1  SW1	25.4 Vdc 18.0 Vac	33.6 Vdc 23.8 Vac	setting to be used for supply voltage of 48 to 250 Vdc or 100 to 240 Vac

■ connection voltage input
□ residual voltage measurement by sum


SW1

□ no residual voltage measurement


SW1

□ residual voltage measurement by open delta-star transformer


SW1

protection

According to the type of Sepam, the following functions are available.

phase overcurrent
(ANSI 50/51)

Three-phase protection of equipment against overloads and phase-to-phase short circuits.

■ substation and transformer applications
The protection includes two units:
□ low set unit, IDMT or definite time,
□ high set unit, definite time, instantaneous or time-delayed.
Different characteristics for IDMT protection: standard inverse time, very inverse time, extremely inverse time, ultra inverse time and RI curve. The wide range of time-delay settings even provides for the long time inverse (LTI) curve.

■ motor applications
The protection is limited to the definite time high set unit.
Recommendations:
□ set higher than starting current,
□ instantaneous operation if the equipment is controlled by a contactor or circuit breaker only,
□ time-delayed operation if the equipment is controlled by a contactor-fuse combination so that the fuse blows before the contactor when the fault current is greater than the contractor's breaking capacity.

earth fault
(ANSI 50/51N or 50/51G)

■ connection and equipment earth fault protection
Earth fault current detection can be provided by:
□ the three phase current transformers,
□ a current transformer (1 A or 5 A), combined with a CSH30 interposing ring CT,
□ a special-purpose core balance CT, CSH120 or CSH200 according to the required diameter, this method being the most accurate one. The two ratings available (2 A and 30 A) provide a very wide setting range.

■ transformer and substation applications
The protection includes two units:
□ low set unit, IDMT or definite time,
□ high set unit, definite time, instantaneous or time-delayed.
The characteristic curves are the same as those for three-phase overcurrent protection.

■ motor applications
The protection has a definite time high set.
Recommendations:
□ connect to special-purpose CSH core balance CT for greater sensitivity,
□ definite time operation.

thermal overload
(ANSI 49)

Protection of equipment against thermal damage caused by overloads.
Thermal overload is calculated according to an appropriate mathematical model to suit each application.
The function comprises:
□ an adjustable trip setting,
□ an adjustable restart authorization setting,
□ a fixed alarm setting.
When a power failure occurs, the % thermal capacity used is reset to zero, unless the thermal overload protection tripped before the outage. In such cases, the initial thermal capacity used value at the time of energizing is equal to the trip setting.
To reset thermal capacity used to zero, there are two solutions:
1 - wait for thermal capacity used to drop below set points E< and E>, acknowledge the protection and cut off the auxiliary power supply,
2 - disable the protection by setting E> to 999%, acknowledge it and cut off the auxiliary power supply.

■ transformer applications
The model includes the transformer's heat rise time constant.

■ motor applications
The model includes two time constants: the heat rise constant, used when the motor is running, and the cooling time constant, used when the motor is shut down. The model also includes the effect of negative sequence current on rotor heating.

negative sequence / unbalance
(ANSI 46)
Protection of equipment against overheating caused by an unbalanced power supply, phase inversion or phase break and against low levels of overcurrent between 2 phases. IDMT time curves.
■ the negative sequence current is calculated from I1 and I3, assuming there is zero earth fault current.

locked rotor / excessive starting time
(ANSI 48/51LR)

Protection of motors that are liable to start with overloads or insufficient supply voltage and/or that drive loads that are liable to become locked (e.g. crushers).
The **locked rotor** protection function is only confirmed after a time delay that corresponds to the normal starting time.
Recommendation:
□ short time operation.

starts per hour
(ANSI 66)

Protection against overheating caused by too frequent starts.
Checking of:
□ the number of starts per hour.
□ the number of consecutive starts.
When the permissible limits are reached, the protection inhibits motor energizing for a preset time period.

■ a power failure causes the complete loss of the record of starts, unless the outage takes place during an inhibited start phase. In such cases, the waiting period, which is restored when the device is energized again, is equal to the initial waiting period, stored at the time the protection tripped. In all cases, the protection becomes fully operational again an hour after it is energized.

■ to totally erase the start-up record, 2 cases may occur:
□ the limitation of the number of start-ups function is disabled (no prohibiting of the number of start-ups in progress), and the user simply switches off the power supply.
□ the limitation of the number of start-ups function is activated (prohibiting of the number of start-ups in progress), and 2 solutions are possible:
1 - wait until the end of the prohibited start-up period and switch off the auxiliary power supply,
2 - disable the protection by setting N1 to 999 and switch off the power supply.

undercurrent
(ANSI 37)
Pump protection against the consequences of priming loss.
The protection detects delayed undercurrent corresponding to motor no-load operation which is typical of a loss of pump priming.

overvoltage
(ANSI 59)

Protecton against abnormally high voltage and checking that there is sufficient voltage for power supply changeover (set point 1) and monitoring of phase-to-phase voltages U32 and U21 (set point 2).

positive sequence undervoltage
(ANSI 27D)

Protection which prevents motor malfunctioning due to insufficient or unbalanced supply voltage.
In order to use this protection, it is necessary to connect Sepam to voltage transformers to measure U21 and U32.

remanent undervoltage
(ANSI 27R)
Monitoring of the clearing of voltage sustained by rotating machines after the opening of the circuit. The protection is used with automatic changeover functions to prevent transient electrical and mechanical phenomena that are caused by fast resupply of power to motors. It monitors phase-to-phase voltage U21.

phase-to-phase undervoltage
(ANSI 27)

Protection used either for automatic control (transfer, load shedding) or for motor protection against voltage sags. The protection monitors dips in each of the phase-to-phase voltages measured.

neutral voltage displacement
(ANSI 59N)
Detection of insulation faults in ungrounded systems by measurement of neutral voltage displacement.
This protection is generally used for transformer incomers or busbars.

overfrequency
(ANSI 81)

Protection against abnormally high frequency.

underfrequency
(ANSI 81)

Detection of variances with respect to the rated frequency, in order to maintain high quality power supply.
This protection can be used for overall tripping or for load shedding.

program logic

Sepam 1000 output operation parameters may all be set via the keyboard.
Operation is defined by:
■ addressing of the internal information on the output relays,
■ relay latching (function 86),
■ program logic (with or without positive contact indication).
The default setting configuration detailed below is appropriate for most applications. In such cases, Sepam is ready to be used and it is not necessary to modify the parameters described in this section.
All the information given in this section applies, regardless of the number of Sepam outputs (2 or 5 according to whether or not Sepam includes the optional ES1 input/output board.

connection of logic outputs

output relay			Sepam S01, T01, M01, M02	Sepam B05	Sepam B06
TRIP	O1	circuit breaker tripping	■	■	■
	O2 (1)	tripping indication	■	■	■
	O3 (1)	inhibit closing	■	■	■
AUX1	O4	Sepam out of service indication (watchdog)	■	■	■
	O5	Sepam out of service indication (watchdog)	■	■	■
AUX2	O6	transmit "blocking input"	■		
		sufficient voltage		■	
		neutral voltage displacement set point 2 tripping			■
AUX3	O7	phase overcurrent tripping information	■		
		undervoltage set point 2 tripping		■	
		underfrequency set point 1 tripping			■
AUX4	O8	earth fault tripping information	■		
		absence of remanent voltage		■	
default settings					
	latched :	latching TRIP output relays			
	logic :	no positive contact indication (except for watchdog relay)			

(1) The O2 and O3 functions are inverted in the case of TRIP relay operation with positive contact indication.

logic input connection

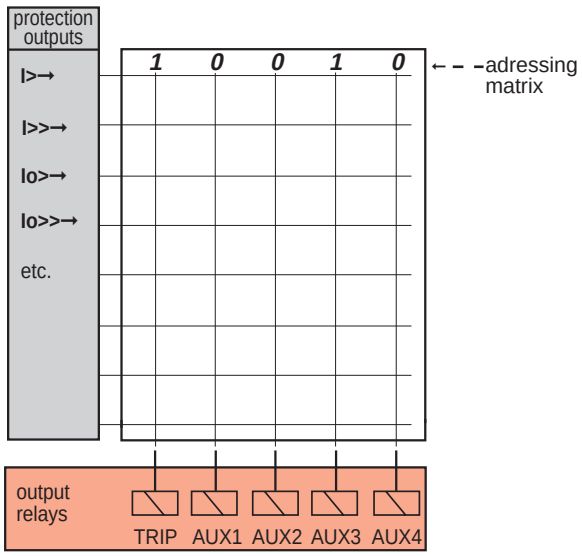
relay		Sepam S01, T01, M01, M02	Sepam B05	Sepam B06
INP1	status readout (status)	■	■	■

modification of program logic

For applications for which the program logic programmed by default is not appropriate, it is possible to obtain the desired configuration by parameter setting.

Adressing of output relays

Each Sepam 1000 protection comprises one or more outputs. These outputs may be addressed, by parameter setting via the keyboard, on any output relay.
Setting addressing parameters consists of filling in the addressing matrix shown below:



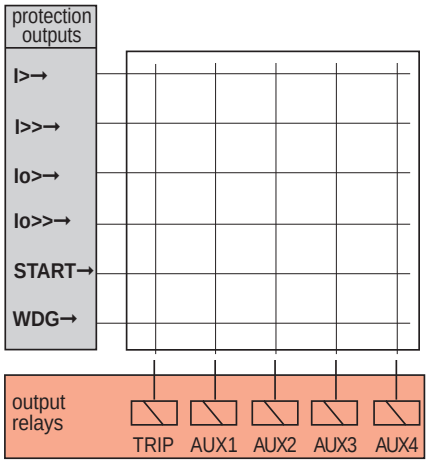
Example of addressing: **I>→ = 10010** indicates that the low set output of the phase overcurrent protection is addressed on the TRIP and AUX3 relays.

The rows in the matrix represent the protection outputs. Each output has a parameter, the name of which is given in the form **xxx→**.
Example: for the low set of the phase overcurrent protection, the addressing parameter is **I>→**.
The 5 columns in the matrix correspond to Sepam's 5 output relays.
An output is addressed on a relay when the matrix contains a **1** at the intersection of the row and the corresponding column. Otherwise, the matrix contains a **0**.

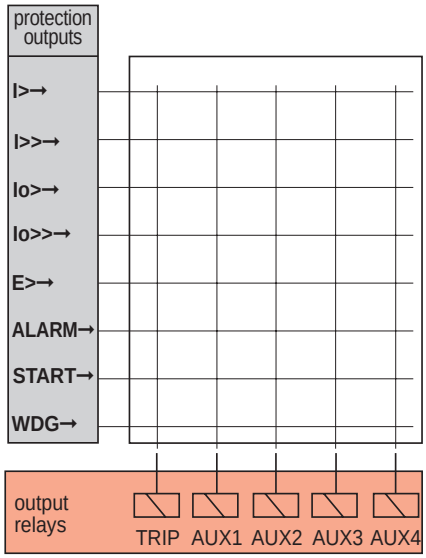
When the optional ES1 board is not used, addressing of relays AUX2, AUX3 and AUX4 is not operational.
All the addressing parameters may be accessed via the keyboard in the **status** loop, ***Input/output*** page. They should be set to the value of the code which corresponds to the desired address.
Remark: watchdog information (**WDG→**) is an output that may be addressed on any relay.

The next page shows the blank addressing matrix for each version of Sepam 1000. This matrix is to be completed in accordance with the installation scheme and is used to generate the addressing codes to be set in Sepam 1000.

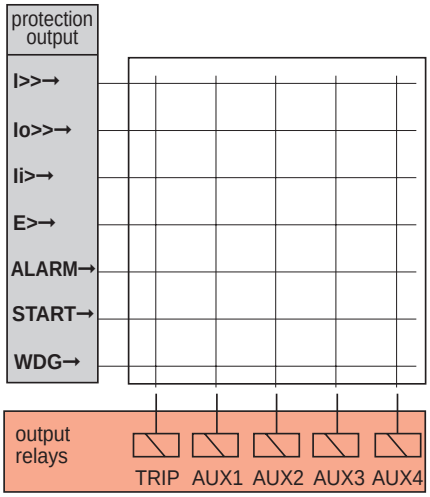
Sepam 1000 addressing matrix type S01



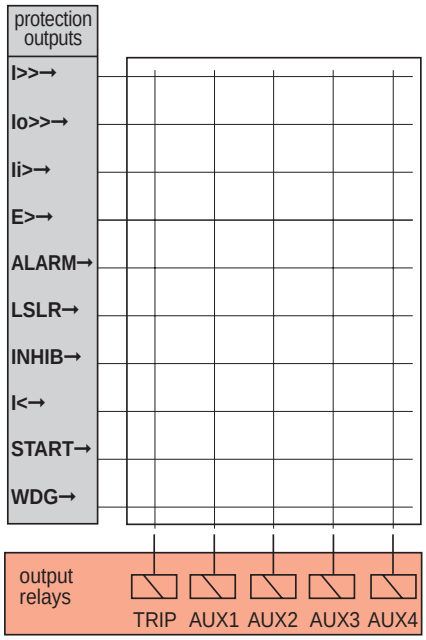
Sepam 1000 addressing matrix type T01



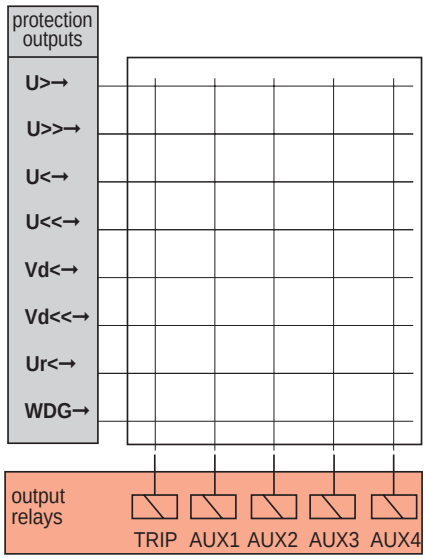
Sepam 1000 addressing matrix type M01



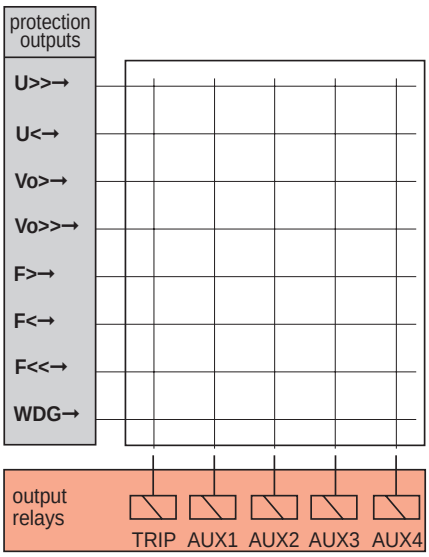
Sepam 1000 addressing matrix type M02



Sepam 1000 addressing matrix type B05



Sepam 1000 addressing matrix type B06



Relay latching

Each of Sepam 1000's 5 relays may be parameter-set as latching or non-latching.
The choice is made by setting the **LATCH** parameter. A code comprising 5 binary digits is used. The same applies for addressing the output relays: the first digit in the code corresponds to the **TRIP** relay, the second to the **AUX1** relay, etc. A **1** indicates that the corresponding relay is latching, a **0** indicates that it is non-latching.
Example: **LATCH = 10000** indicates that the **TRIP** relay is latching whereas the others are non-latching. This is the **LATCH** parameter default setting.
Some outputs are never latching, even if they are addressed on a latching relay.

These outputs are:
- watchdog (**WDG→**)
- logic discrimination output (**START→**)
- inhibit start (**INHIB→**)
- thermal alarm (**ALARM→**)
- remanent undervoltage protection output (**Ur→**)
- overvoltage set point 1 output (**U>→**)

Program logic for relays with positive contact indication

Relays with positive contact indication control are activated in normal status and drop out when tripping occurs. This inverted progam logic makes tripping possible for all cases of Sepam unavailability (power supply outage or internal failure). Undervoltage releases are conventionally used with this function.

Each of Sepam 1000's 5 relays may be set for program logic with positive contact indication.
The choice is made by setting the **PS** parameter. A code comprising 5 binary digits is also used. A 1 signifies standard program logic.
Example: **PS = 10001** signifies that the **TRIP** and **AUX4** relays have positive contact indication.
The default setting of the **PS** parameter is **00000**: all the relays have standard program logic by default.
Special case: any relay on which the watchdog output (**WDG→**) is addressed has positive contact indication, whatever the setting of the **PS** parameter.

logic input operation parameter setting

The Sepam 1000 logic input operation parameters may be set via the keyboard. Parameter setting **INP1**, accessible in the **status** loop, ***Input/ ouput*** page, is used to select the function.

Status readout function: (default parameter setting)

The **INP1 = STATUS** setting assigns the status readout function to the logic input. Input status may be accessed on the display unit through the **INPUT** parameter, which is called up via the **meter** loop, ***Other data*** page.
INPUT = 0: the input is is low status
INPUT = 1: the input is in high status
This function is available for all input parameters.

Blocking function

The **INP1 = BLOCK.** setting assigns the blocking function to the logic input. This function is part of the Sepam 1000 S01 and T01 type logic discrimination system.

Acknowledgement function

The **INP1 = RESET** setting assigns the remote acknowledgement function to the logic input.
When the input is switched to high status:
- all the latched protections are acknowledged,
- the message on display is acknowledged.

If the fault which is at the origin of the fault is still present, it is impossible to acknowledge the corresponding protection.
Unlike the **reset** key on the front of the device, the logic input cannot be used to reset the maximum demands and the running hours counter to zero.

Remote tripping function

The **INP1 = TRIP** setting assigns the remote tripping function to the logic input.
When the input is switched to high status, the **TRIP** relay is controlled throughout the high status period, whether the relay is latching or non-latching.
There is no trip indication on the front of Sepam.

Sepam comprises self-testing and self-diagnosis to facilitate installation maintenance.

indicator lamps and display messages

■ green indicator lamp on
Sepam is energized.
■ no indicator lamps on
There is probably an auxiliary power fault.

Check the auxiliary power supply, the connections on the AS' module and perform the lamp test.

■ red 🔧 lamp indicates internal Sepam faults.
Sepam continuously performs on-line internal tests. When the test results are negative, Sepam automatically runs a series of sequences which result in one of the following:
□ automatic reinitialization (minor fault, e.g. transient auxiliary power supply outage).
Sepam carries out a complete restart sequence. If the restart is successful, Sepam operates again normally. All the output relays are de-energized (1),
□ switching to the fail-safe position.
Sepam goes into the fail-safe position. All the output relays drop out (1) in order to avoid inadvertent commands.

unwanted tripping, no tripping

Incorrect parameter setting may cause unwanted tripping or no tripping (2).

Check the parameters and settings.

tests

■ lamp test:
when the user presses the **meter** and **status** keys at the same time, all the indicators on the front of the device light up as well as the display unit.
■ output relay test
Output relay operation may be checked by the following two methods:
□ readout of output relay stauts:
Output relay status is accessed on the display unit via the **OUTPUT** parameter in the **meter** loop, ***Other data*** page.
OUTPUT is a code which comprises 2 or 5 binary digits that corrrespond to the 2 or 5 Sepam relays. A **1** signifies that the corresponding relay is activated, a **0** signifies that it is de-activated.
Example 1: **OUTPUT = 01---** the **TRIP** relay is de-activated, the **AUX1** relay is activated and Sepam has only 2 output relays.
Example 2: **OUTPUT = 01011** the **TRIP** and **AUX2** relays are de-activated, the **AUX1**, **AUX3** and **AUX4** relays are activated.
This function is used to verify the addressing and program logic settings.
■ output relay test
This function is used to activate each output relay separately. A parameter called **TEST** appears in the **status** loop, ***Input/output*** page. In parameter setting mode, the **data-** and **data+** keys are used to designate one of the Sepam relays (e.g. **TEST = AUX1**). To change relay status, the user presses the **enter** key.
This function is used to test the operation of each relay and the circuit in which they are included.

Sepam replacement

To replace Sepam:
■ dismantle the Sepam to be replaced,
■ mount the Sepam replacement,
■ set microswitches SW1 and SW2 on the rear of the new device to the same settings as on the Sepam being replaced,
■ install the connectors, checking their markings,
■ energize Sepam,
■ set Sepam parameters to the same values as the Sepam that has been replaced.

N.B. *To disconnect current inputs with the system on-line, never disconnect the wires. Instead, remove the CT connector from the rear of Sepam.*

(1) which may cause tripping with undervoltage program logic ("positive contact indication" scheme").
(2) All the settings should be based on a network discrimination study that is to be carried out prior to commissioning.

Sepam 1000 identification

Each Sepam is identified by a 14-character reference which describes its hardware and functional components in accordance with the chart below.

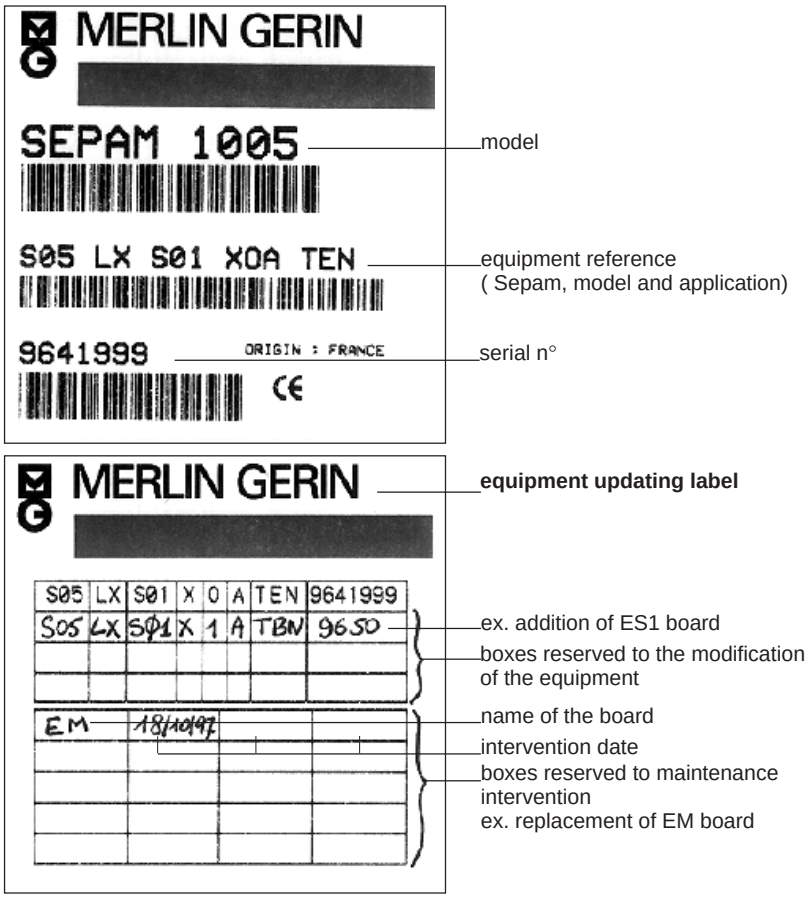
series	type	model	version	communication	nb. of logic I/O boards	working language	current sensor	auxiliary power supply	operating temperature
S05	TX	B = Busbars	1 to 99	X = none	0 = 0	A = English	C = CS	A = 24/30Vdc	N = -5/55°C
	LX	M = Motors			1 = 1		T = CT	B = 48/125Vdc	
		S = Substations					X = none	C = 220/250Vdc	
		T = Transformers						E = 100/127Vac	
								F = 220/240Vac	

The reference is indicated on Sepam.

■ *to identify a Sepam, check the label on the right-hand side of the device which gives the product's hardware and functional characteristics (1).*

Example of Sepam reference:

S05	Sepam 1005
LX	model
S	substations
01	01
X	no communication
1	1 logic I/O board
A	English
T	CT
B	48V
N	-5/+55°C



Example of a label on the right side of Sepam.

Sepam 1000 documentation

documentation (1)	reference (2)	content	use
Sepam range	AC 0401	summarized description of the Sepam range	selecting the type of Sepam: 100, 1000, 2000
Sepam 1000	AC 0396	characteristics, selection table, connections	installation studues
tests	3140743	testing methods	function testing
installation	3140744	cubicle mounting instructions	installation, parameter setting
use and commissioning (3)	3140742	description of display and parameter settings	commissioning, use

(1) This documentation can be provided by your Merlin Gerin correspondent
(2) References: followed by F for French documents, by A for English documents
(3) Supplied with Sepam

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