Data Sheet

SELCO Controlin

# M1000
# Process Alarm Monitor

## Reliable Supervision and Control

- 10 inputs with LED indications
- Supports both NO/NC input contacts
- 10 open collector outputs
- Built-in siren relay
- Text label for alarm descriptions
- First alarm indication
- Programmable time delays, reset functions, etc.
- RS232 interface for PC based configuration
- RS485 interface for field-bus communication
- Standard MODBUS-RTU protocol
- Available with degree of protection IP54 at front
- Certified for marine use

# M1000 Process Alarm Monitor

Figure 1: The M1000 Process alarm monitor with the Standard IP54 Front

The SELCO M1000 Process Alarm Monitor is a compact 10 channel programmable unit with many features. An input signal originating from a potential free contact, normally open (NO) or normally closed (NC), will cause the appropriate alarm LEDs to flash and simultaneously the related output will activate. The internal siren relay will be activated on the detection of every new alarm.

The M1000 unit has indications of first alarm, following alarms and acknowledged alarms and possibility of cable fault indication. Multiple M1000 units can be interconnected to form a large-scale alarm system.

Alarm related parameters like time delays, reset functions and other features can be configured by use of 16 programming switches. Alternatively, the M1000 can be configured via the built-in RS232 interface from a standard ANSI / VT100 terminal, e.g. a PC with the HyperTerminal application (which is a part of the Microsoft Windows operating system).

The M1000 can be configured for cable monitoring (indication of cable break and/or short-circuit), and it can be configured to monitor its own supply and insulation level.

The M1000 is also equipped with a built-in RS485 serial communication interface. The RS485 interface supports the standard MODBUS-RTU protocol, enabling remote equipment to read and write alarm and LED states.

Flush mounted unit with standard measurements of 144 x 144 x 35mm, available with protection degrees IP54 at the front.

## General Function

The function described in this section assumes that the M1000 unit has been configured for default operation – all the programming switches are ON and the $E^2$PROM is reset using PC based configuration.

A potential free contact connected to one of the 10 input terminals will cause the appropriate alarm channel to activate. The activation of an alarm is indicated by a flashing light in the related LEDs and the activation of the related open collector output.

First incoming alarm is indicated with a quick flashing light, following alarms are indicated with slow flashing light. The LEDs will keep flashing until the alarms are acknowledged, even though the signals have been disconnected from the input terminals.

Pressing the RESET button will acknowledge all new alarms and all LEDs will change to steady light, provided that the related input signals are still present upon acknowledgement. Pressing the RESET button will also cause the siren relay to deactivate.
Each open collector output will stay active as long as the related LEDs are lit.

## Applications

SELCO is widely known for its line of generator controls. But the M1000 is not only intended for use with generator sets; today thousands of M1000 units survey alarm points all over the world.

The M1000 unit has been installed aboard ships, at chemical plants, at nuclear facilities and many other places where clear and concise alarm monitoring is absolutely vital.

The M1000 is a versatile and programmable process alarm monitor and controller. It can be used for shutting down alarm dependent equipment controlled by the unit's open collector outputs.

Multiple M1000 units can easily be interconnected to form a large-scale alarm system. A number of M1000 units can also be used as part of a large computer based alarm system with RS485 / MODBUS based bus communication.

Still, the simplicity can be maintained with the text label based design. Besides information on active alarms on the text label, you also have information on which alarms to expect.

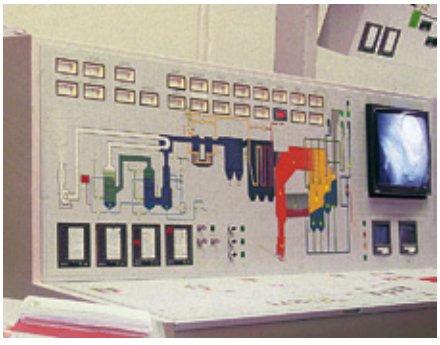


Figure 2: Control Room Featuring M1000 Process Alarm Monitors

# Terminal Connections

**TEST - terminal 11**
Will activate all LEDs to perform a lamp test. Active when connected to positive supply (terminal 28).

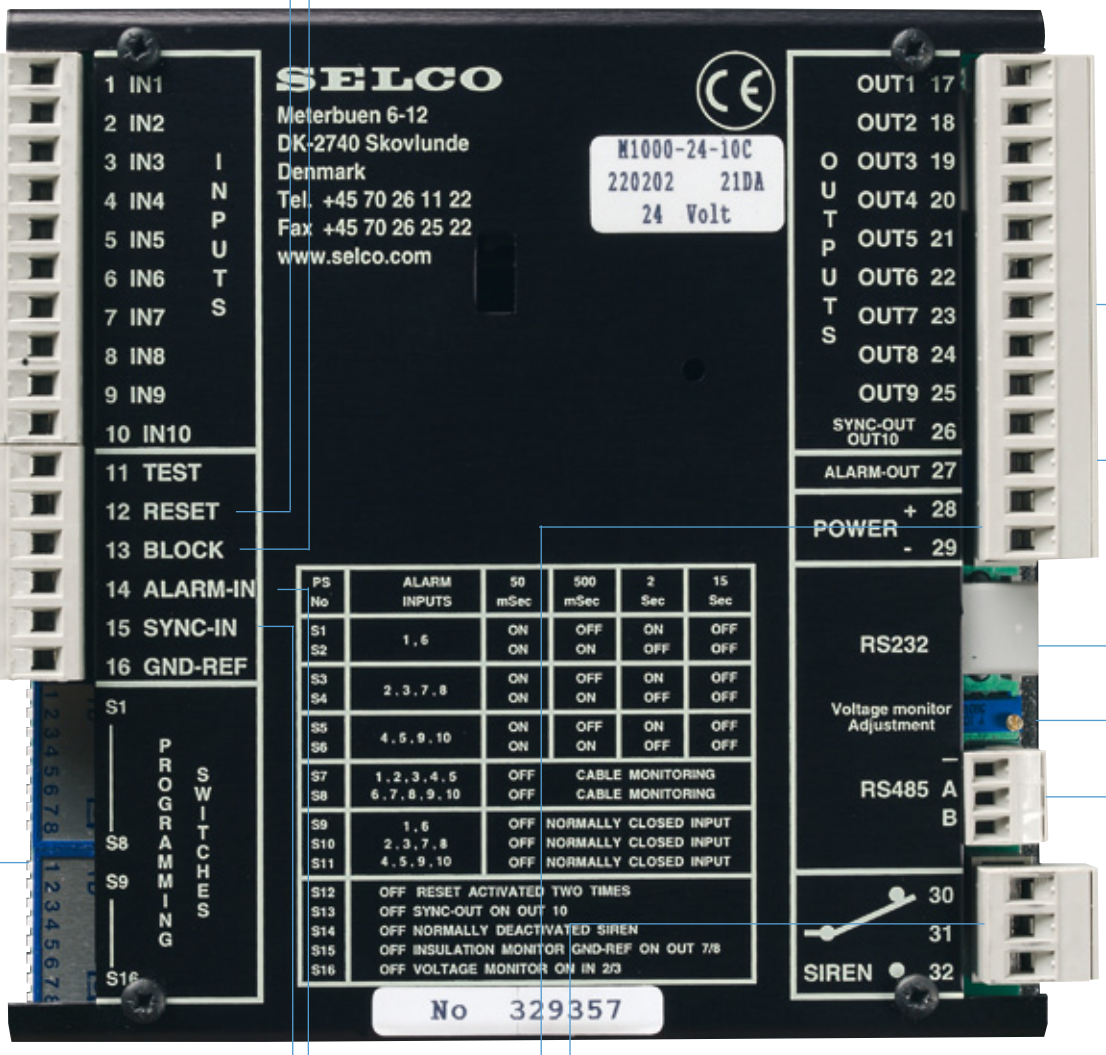
**INPUTS - terminals 1-10**
Alarm inputs for connection of potential free contacts, normally open or normally closed with positive reference. Negative reference is also possible through use of external pull-up resistors.

**RESET - terminal 12**
Resets the siren relay and the ALARM-OUT signal (terminal 27). Flashing light in the LEDs will change to steady light if the input signal is still active. Active when connected to positive supply (terminal 28).

**BLOCK - terminal 13**
Will block for new incoming alarms. Active when connected to positive supply (terminal 28).

**ALARM-OUT - terminal 27**
Activates when the first alarm is detected. Used for indication of first incoming alarm in a multiple unit installation. ALARM-OUT is an open collector output.

**OUTPUTS - terminals 17-26**
Open collector outputs for remote control of relays or external lamps. Operates as "electronic contacts" to minus supply (negative reference when active).




**PROGRAMMING SWITCHES**
Programming switches S1 - S16 are used for configuration. The table printed on the rear side of the unit describes the functions.

**GND-REF - terminal 16**
Used as a ground reference for the insulation monitoring function. Configured by programming switch S15.

**ALARM-IN - terminal 14**
Provides indication of first incoming alarm in a multiple unit installation.

**SYNC-IN - terminal 15**
Provides synchronization of LED flashing between units in a multiple unit installation. Configured by programming switch S13.

**SIREN - terminals 30-32**
Internal siren relay with a potential free contact, which is activated at any new alarm.

**POWER - terminals 28-29**
DC power supply.

**RS485**
Interface for field-bus communication. Supports MODBUS-RTU or SELCO BUS protocol.

**Voltage Monitor Adjustment.**
Adjustment of the voltage monitor.

**RS232**
Interface for PC based configuration. Cable with RJ11 modular plug can be supplied from SELCO.

## Input and Output Terminals

All input terminals are located on the left side of the unit and all output terminals are located on the right side (facing the rear plate).

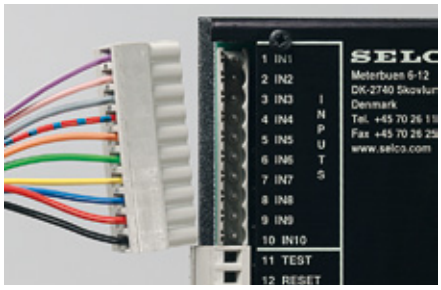



Figure 3: Rear Side Input Terminals

The inputs are considered active when connected to positive supply and inactive when disconnected.
Please note that the alarm inputs can be configured to operate with normally open as well as normally closed contacts.
The outputs are "Open Collector" outputs.
An open collector output will be at negative supply level when active and at positive supply level when inactive. No current originates from an open collector output, it should only be considered an electronic contact to minus supply level. External voltage, equal to the unit supply voltage, must always be provided to drive the relay or lamp controlled by an open collector output. Maximum drive capacity of an output is 150mA.

## Input Delays

Each input can be configured with an input delay. Programming switches S1 to S6 are used to select a predefined delay for a combination of inputs.
Input delays are convenient where alarms are dependent upon the time of activation, e.g. a freezer door alarm - alarm condition would occur only if the door is left open for more than 15 seconds. Delay values are according to the programming table.
Other delay configurations are available using PC based configuration.

## Cable Monitoring

By setting switch S7 and S8 to OFF, cable monitoring is activated for the cables connecting the potential free contacts to the inputs. Cable monitoring provides extra security to the alarm system. Cable faults are indicated with short flashing pulses on the corresponding alarm channels. Cable fault indications will be overridden by activation of input alarms and indicated with normal alarm flash or steady light indication.

Two types of cable monitoring are available: Default Cable Monitoring and Extended Cable Monitoring. Extended Cable Monitoring can be enabled using PC based configuration.
In Default Cable Monitoring there is only cable break monitoring (using measuring resistor R1) for normally open inputs and only short circuit monitoring (using measuring resistor R2) for normally closed inputs.
However, the system is still safe as other cable faults will be indicated as alarms.

In Extended Cable Monitoring there are cable break monitoring and short circuit monitoring for both types of inputs. In addition to being safe a more correct indication is now achieved. In this case both R1 and R2 should be used. Connections are shown in figures 4 and 5.

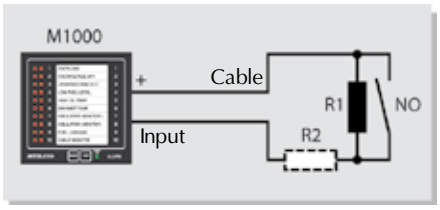



Figure 4: Normally Open Input. Cable break monitoring (and short circuit monitoring)

For 12-24V DC unit: R1 = 82kΩ, (R2 = 4.7kΩ)
For 48-110V DC unit: R1 = 180kΩ, (R2 = 39kΩ)

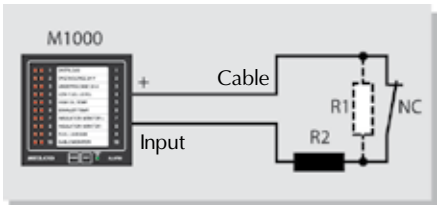



Figure 5: Normally Closed Input. Short circuit monitoring (and cable break monitoring)

For 12-24V DC unit: R2 = 4.7kΩ, (R1 = 82kΩ)
For 48-110V DC unit: R2 = 39kΩ, (R1 = 180kΩ)

## Normally Open or Normally Closed Contacts

Programming switches S9 to S11 determine the state and operation of the potential free contact connected to an input terminal. A normally open (NO) contact is disconnected when no alarm is pre sent. A normally closed (NC) contact provides a signal when no alarm is present.

Normally closed relay contacts are often used as they provide the safety of alarm monitoring in case the supply is lost. Individual selections of normally open or normally closed contacts are possible using PC based configuration.

## Reset Activated Two Times

After reset with programming switch S12 in OFF position, the steady light is maintained until reset is again activated, provided that the fault has been cleared. Optional reset functions are available using PC based configuration.

## Normally Deactivated Siren

The default operation of the siren relay will cause terminals 30 and 31 to be shorted during alarm or supply failure. Setting programming switch S14 to OFF will invert the function so that connection between terminals 31 and 32 exists only during alarm condition.

## Sync-Out on Output 10

The sync-out function provides the possibility of synchronized LED flashing between multiple M1000 units. The selection of this function by programming switch S13 on one arbitrary unit disables the default output function of terminal 26. Sync-out has no functional importance other than providing synchronized flashing. Connection according to diagram shown in figure 6.

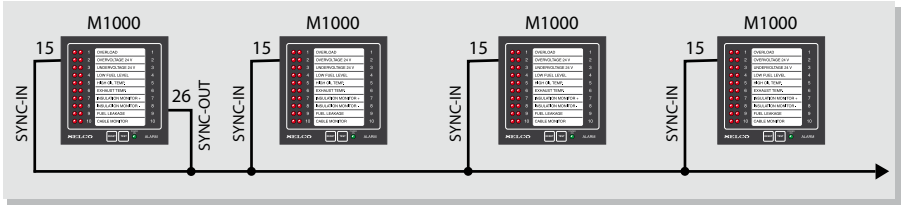



Figure 6: Wiring for Synchronized Flashing

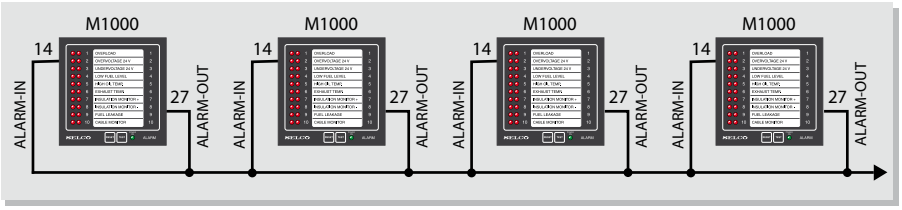


Figure 7: First Incoming Alarm on Multiple Units

## First Incoming Alarm on Multiple Units

The M1000 includes a quick flashing light indicating the first incoming alarm. This function can be extended to cover multiple units, thus it will be possible to indicate the first of e.g. 50 alarms.

In order to obtain this function, a single wire must be interconnected between all the M1000 units. The wire must have connection to ALARM-IN (terminal 14) and ALARM-OUT (terminal 27) on each unit as shown in figure 7.

## Insulation Monitoring

By setting programming switch S15 to OFF and connecting GND REF (terminal 16) to ground, channels 7 and 8 are configured for insulation monitoring.

If the insulation resistance between ground (terminal 16) and positive supply (terminal 28) becomes less than 25kΩ ± 8kΩ, channel 8 will indicate alarm. If insulation resistance between ground and negative supply (terminal 29) becomes less than 25kΩ ± 8kΩ, channel 7 will indicate alarm.

The resistance values are 50kΩ ± 10kΩ for the 48-110V DC version.

## Voltage Monitoring

By setting programming switch S16 to OFF, channels 2 and 3 are set for supply voltage monitoring.

A resistor selected according to the voltage monitoring formula, must be connected to terminal 2. The voltage monitoring wiring diagram shows the connection. See figure 8.

External voltage supply should then be adjusted to lower voltage limit $U_L$. Press and hold RESET while adjusting the potentiometer on the rear side of the unit, until alarm is indicated on channel 3.

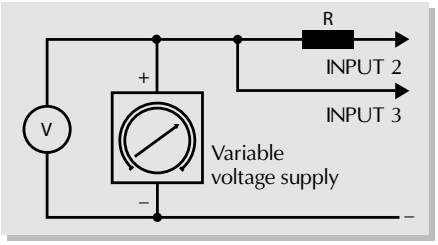


Figure 8: Wiring for Voltage Monitoring

The calculated resistor determines a fixed distance between lower voltage limit indicated on channel 3 and upper voltage limit indicated on channel 2. By adjusting the potentiometer, over and under voltage limits can be changed, but still with a fixed percentage separation.

Reset the alarm unit and check that alarm occurs at the voltage limit intended.

Voltage Monitoring Formula

1. Valid for the 12-24V Alarm Unit:

$$R = \frac{16 \times (U_O - U_L)}{U_L}\ k\Omega$$

2. Valid for the 48-110V Alarm Unit:

$$R = \frac{84.2 \times (U_O - U_L)}{U_L}\ k\Omega$$

$U_O$ = Over voltage limit
$U_L$ = Lower voltage limit

## Input Blocking

Connecting terminal 13 to positive supply will prevent the M1000 from detecting new alarms. Blocking is released by disconnecting the supply from terminal 13. Direct connection to the supply will block all inputs.

Blocking of individual inputs can be done by use of external components or it can be done from a controller (PC or PLC) via the RS485 interface.

- Direct connection:
  RS232 or the RS485 interface.
  All inputs are blocked
- 84kΩ in series:
  Inputs 1, 2, 3, 6, 7 and 8 are blocked
- 4.7kΩ in series:
  Inputs 1 and 6 are blocked

The blocking function cannot be used together with cable monitoring.

## Test Function

The TEST push button and the TEST terminal (terminal 11) provide illumination of all LEDs.
An extended test function is available by the simultaneous activation of both the TEST and RESET push buttons.
Press and hold the two push buttons: LEDs will illuminate, after 3 seconds the siren relay will activate, and after 6 seconds the outputs will activate.

## Dimming

It is possible to adjust the brightness of the front panel LEDs by pressing the TEST push button, or connecting TEST terminal (terminal 11) to positive supply (terminal 28), for more than 6 seconds.
Dimming is done in 4 consecutive levels.
The default brightness is re-obtained by activation of the TEST signal for 2 seconds.

Dimming can also be done from a controller (PC or PLC) via the RS485 interface.

## Configuration via the RS232 Interface

The M1000 can be configured via the RS232 interface. A standard ANSI / VT100 terminal is used as the programming tool (e.g. the HyperTerminal which is a part of the Microsoft Windows operating system).

Configuration via the RS232 interface greatly expands the number of programmable options. Configuration via the RS232 provides an adjustable delay for each individual alarm, extra reset functions, and many other features not available by the programming switches.
A detailed description of how to configure the M1000 by the RS232 interface can be downloaded from SELCO's web- site at www.selco.com.

## RS485 interface, MODBUS-RTU protocol

The M1000 is equipped with a 2-wire RS485 interface which supports communication by the standardized MODBUS-RTU protocol. A MODBUS master (e.g. PC, PLC) can write and read information to and from any M1000 unit connected to the common RS485 bus.

The RS485 interface makes it possible to reset the siren relay and all LEDs. An LED test can be performed, the LEDs can be dimmed from 0 to 100 %, and there is a command for LED synchronization. The master can also individually block and unblock each channel. Each channel can be individually reset.
It is also possible to set a "virtual input" on the M1000 via the RS485 interface. A "virtual input" has exactly the same function as a physical input and the "virtual input" should be understood as being in parallel with the physical input. This enables the MODBUS master to repeat one or more alarms from one M1000 to a channel on another M1000.

A detailed description of the MODBUS protocol can be downloaded from the SELCO web-site at www.selco.com.
In addition to the standard MODBUS-RTU protocol the unit is also compatible with the SELCO BUS protocol. The SELCO BUS protocol can be activated using PC based configuration.
and destination units / LEDs can be de

## M1000 as a repeating panel

Alarms from the M1000 can also be repeated at a different location on another M1000 as illustrated in figure 10.

The outputs 1, 4 and 9 are hardwired together through a "pull-up" resistor of 4.7kΩ. When one of the outputs is activated the input voltage to the upper M1000 will be at zero volts and indicated as a group alarm.

Input 1 and 6 on this M1000 should be configured as normally closed inputs (programming switch S9 off).

### Accessories

- M0700-00 Universal PCB
  for 12V-110V DC
  Printed circuit board (PCB) for mounting of external resistors, diodes and other components to be used in connection with inputs and outputs. To be mounted on the terminals on the rear side of the M1000.
- M0700-10 Positive Output
  for 12-48V DC
  This board is mounted on the output terminals of the M1000. The PCB will convert outputs from negative going to positive going.
- M0700-20 Relay PCB for 24V DC
  The relay PCB is mounted on the output terminals of the M1000. Includes a small relay and an open collector output for each of the M1000 outputs.
- M0800-00-00 IP54 Cover with Handle
- M0800-00-01 IP54 Cover with Key

Other accessories available. Please consult SELCO for further details.

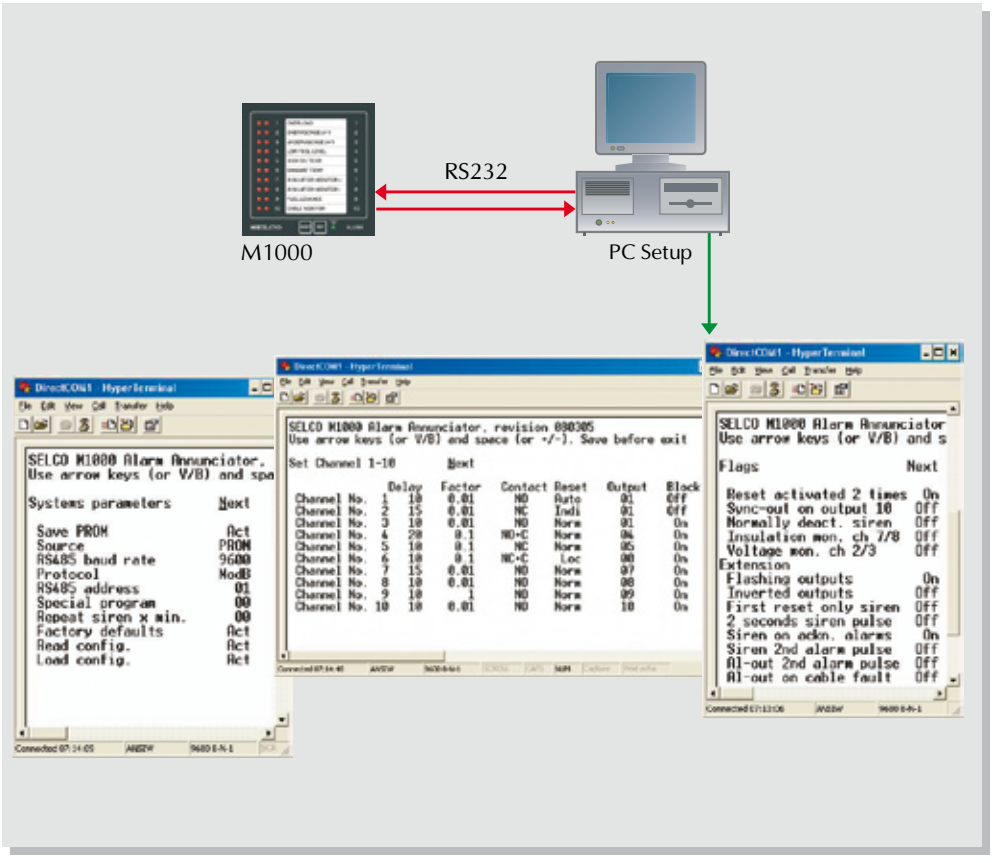



Figure 9: Configuration via RS232 Interface using the HyperTerminal

## Wiring Example

Figure 11 shows the default connection of the input and output terminals of the M1000 unit. Inputs are connected to positive supply by potential free contacts. Lamps are connected to the outputs; the lamps are supplied from same source as the unit. External switches are provided for TEST, RESET and BLOCK.

## Installation

The M1000 front includes a text label for easy description of the 10 alarms. The label texts can be written using an ordinary typewriter or it can be printed on a printer. SELCO provides a Microsoft Word template. The label is easily inserted behind the front plate window by a small opening. See figure 12.

The M1000 is a flush mounted unit. Cut-out measurements: 138 x 138mm. The unit is secured by tightening four mounting brackets against the switchboard plate.

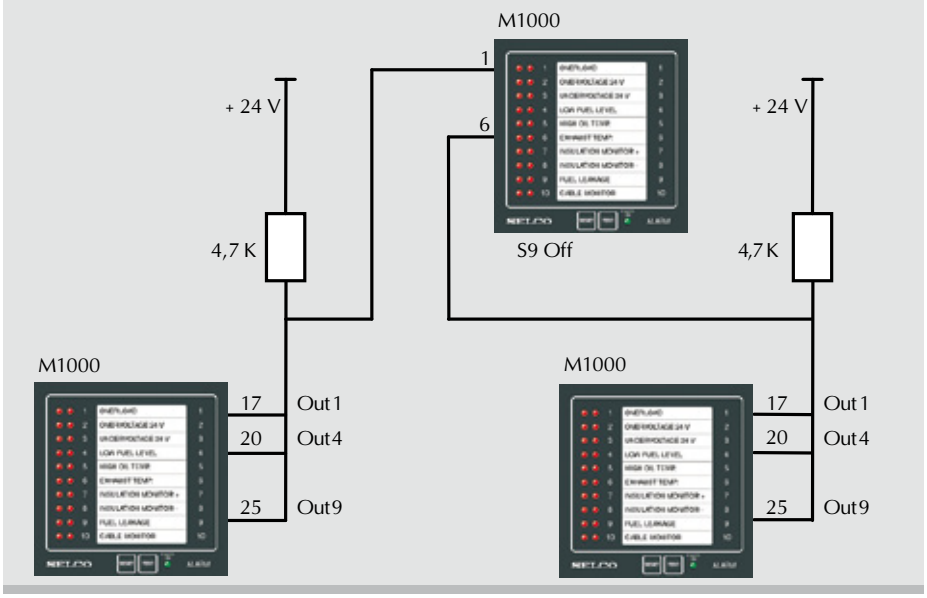



Figure 10: M1000 as a repeating panel

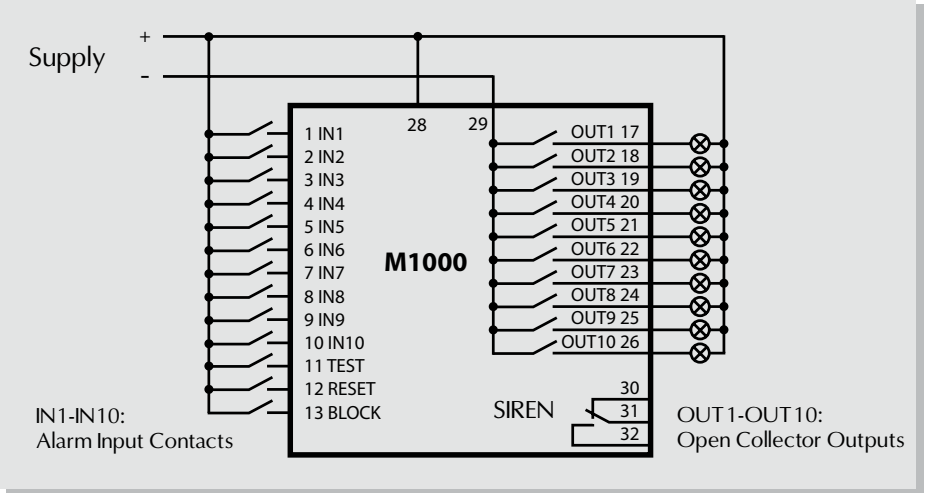



Figure 11: Wiring Example, Default Connection

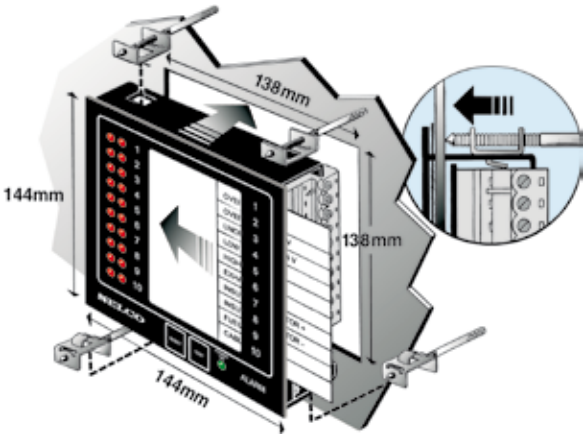



Figure 12: Installation

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# Specifications

## M1000 Process Alarm Monitor

### Type Approvals and Certificates

The SELCO M1000 has been designed and tested for use in harsh environments. The input and output terminals include circuitry especially designed to protect the unit from electric noise and high level voltage spikes. The unit is based on standard components providing long term durability. The M1000 unit carries the CE label and has been approved by the major marine classification societies.

American Bureau of Shipping
Bureau Veritas
ClassNK
Croatian Register of Shipping
Det Norske Veritas
Germanischer Lloyd
Lloyd's Register of Shipping.
Polish Register of Shipping
Registro Italiano Navale
Romanian Register of Shipping
Russian Register of Shipping

| | |
|---|---|
| **Voltage supply** | Type M1000-24-XXC: 12-24V DC -30% / +30% (8-32V DC)<br>Type M1000-11-XXC: 48-110V DC -30% / +40% (33-155V DC) |
| **Max. power consumption** | 180mA |
| **Ambient temperature range** | -10°C /+70°C (also available for -40°C /+70°C) |
| **Siren relay contact** | 220V AC / 2A. 30V DC / 2A, 30W |
| **Output** | Max.150mA per channel |
| **LED flash frequency** | Slow Flashing Light: 1.25Hz ±10%<br>Quick Flashing Light: 5Hz ±10% |
| **Delay tolerance** | ±15% |
| **Resistance in sensing cable** | Max. 1000Ω |
| **Insulation monitor** | 25kΩ±8kΩ (50kΩ±10kΩ for M1000-11-XXC) |
| **Impulse test** | 4.5kV 1/50µsec. |
| **EMC** | CE according to EN50081-1, EN50082-1, EN50081-2, EN50082-2 and EN61000-2-6 |
| **Programming** | 16 dip-switches or via RS232 interface |
| **Communication** | RS485 interface |
| **Protocol** | MODBUS-RTU or SELCO BUS Protocol |
| **Baud rate** | 1200, 2400, 4800, 9600 |
| **Parity** | None |
| **Data bits** | 8 |
| **Stop bits** | 1 |
| **Weight** | 0.4kg |
| **Dimensions** (H x W x D) | 144 x 144 x 35mm |
| **Panel cut out** | 138 x 138mm |
| **Protection degree at front** | IP54 (see Type Description) |

The specifications are subject to change without notice.

### Type Description

| Type | Supply | Function |
|---|---|---|
| M1000.0040 | 48-110V DC | IP54 front |
| M1000.0080 | 12-24V DC | IP54 front |
| M1000.0220 | 12-24V DC | Internal siren, IP54 at front |


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