PERFORMANCE
MADE
SMARTER

Product Manual
4511
Communication enabler



ATEX | IECEx | FM APPROVED | c UL us LISTED | DNV | CE

TEMPERATURE | I.S. INTERFACES | COMMUNICATION INTERFACES | MULTIFUNCTIONAL | ISOLATION | DISPLAY

No. 4511V101-UK
From serial no.: 141590001

PR electronics

6 Product Pillars
to meet your every need

Individually outstanding, unrivalled in combination

With our innovative, patented technologies, we make signal conditioning smarter and simpler. Our portfolio is composed of six product areas, where we offer a wide range of analog and digital devices covering over a thousand applications in industrial and factory automation. All our products comply with or surpass the highest industry standards, ensuring reliability in even the harshest of environments and have a 5-year warranty for greater peace of mind.



Our range of temperature transmitters and sensors provides the highest level of signal integrity from the measurement point to your control system. You can convert industrial process temperature signals to analog, bus or digital communications using a highly reliable point-to-point solution with a fast response time, automatic self-calibration, sensor error detection, low drift, and top EMC performance in any environment.



We deliver the safest signals by validating our products against the toughest safety standards. Through our commitment to innovation, we have made pioneering achievements in developing I.S. interfaces with SIL 2 Full Assessment that are both efficient and cost-effective. Our comprehensive range of analog and digital intrinsically safe isolation barriers offers multifunctional inputs and outputs, making PR an easy-to-implement site standard. Our backplanes further simplify large installations and provide seamless integration to standard DCS systems.



We provide inexpensive, easy-to-use, future-ready communication interfaces that can access your PR installed base of products. The detachable 4501 Local Operator Interface (LOI) allows for local monitoring of process values, device configuration, error detection and signal simulation. The next generation, our 4511 Remote Operator Interface (ROI) does all that and more, adding remote digital communications via Modbus/RTU, while the analog output signals are still available for redundancy.
With the 4511 you can further expand connectivity with a PR gateway, which connects via industrial Ethernet, wirelessly through a Wi-Fi router or directly with the devices using our Portable Plant Supervisor (PPS) application. The PPS app is available for iOS, Android and Windows.



Our unique range of single devices covering multiple applications is easily deployable as your site standard. Having one variant that applies to a broad range of applications can reduce your installation time and training, and greatly simplify spare parts management at your facilities. Our devices are designed for long-term signal accuracy, low power consumption, immunity to electrical noise and simple programming.



Our compact, fast, high-quality 6 mm isolators are based on microprocessor technology to provide exceptional performance and EMC-immunity for dedicated applications at a very low total cost of ownership. They can be stacked both vertically and horizontally with no air gap separation between units required.



Our display range is characterized by its flexibility and stability. The devices meet nearly every demand for display readout of process signals, and have universal input and power supply capabilities. They provide a real-time measurement of your process value no matter the industry, and are engineered to provide a user-friendly and reliable relay of information, even in demanding environments.

Communication enabler 4511

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Warning



GENERAL

This device is designed for connection to hazardous electric voltages. Ignoring this warning can result in severe personal injury or mechanical damage.
To avoid the risk of electric shock and fire, the safety instructions of this guide must be observed and the guidelines followed. The specifications must not be exceeded, and the device must only be applied as described in the following.
Prior to the commissioning of the device, this installation guide must be examined carefully.
Only qualified personnel (technicians) should install this device.
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.



HAZARD-OUS VOLTAGE

Warning

Until the device is fixed, do not connect hazardous voltages to the device. The following operations should only be carried out on a disconnected device and under ESD safe conditions:

General mounting, connection and disconnection of Modbus cable.
Troubleshooting the device.



CAUTION

Warning

Repair of the device must be done by PR electronics A/S only.

Symbol identification



Triangle with an exclamation mark: Read the manual before installation and commissioning of the device in order to avoid incidents that could lead to personal injury or mechanical damage.



The CE mark proves the compliance of the device with the essential requirements of the directives.



The double insulation symbol shows that the device is protected by double or reinforced insulation.



Ex devices have been approved according to the ATEX directive for use in connection with installations in explosive areas.

Safety instructions

Receipt and unpacking

Unpack the device without damaging it and check whether the device type corresponds to the one ordered. The packing should always follow the device until this has been permanently mounted.

Environment

The device is manufactured for indoor use. Avoid direct sunlight, dust, high temperatures, mechanical vibrations and shock, as well as rain and heavy moisture. If necessary, heating in excess of the stated limits for ambient temperatures should be avoided by way of ventilation.

The device may be used in Overvoltage Category II, Pollution Degree 2 at an altitude up to 2000 m.

Mounting

Only qualified technicians who are familiar with the technical terms, warnings, and instructions in this installation guide and who are able to follow these should connect the device. Only devices which are undamaged and free of moist and dust may be installed. The device may be installed and supplied by PR electronics 4000 and 9000 series only.
Should there be any doubt as to the correct handling of the device, please contact your local distributor or, alternatively,

PR electronics A/S
www.prelectronics.com

Calibration and Adjustment

During calibration and adjustment, the measuring and connection of external voltages must be carried out according to the specifications of this manual. The technician must use tools and instruments that are safe to use.

Cleaning

When disconnected, the device may be cleaned with a cloth moistened with distilled water.

IECEx, ATEX installation in Zone 2

IECEx DEK 13.0026 X ..... Ex nA IIC T5 Gc

DEKRA 13ATEX0098 X..... II 3 G Ex nA IIC T5 Gc

For safe installation the following must be observed

The device must be installed by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this area.

Year of manufacture can be taken from the first two digits in the serial number.

The devices must be installed in a suitable enclosure providing a degree of protection of at least IP54 according to EN60529, taking into account the environmental conditions under which the equipment will be used.

To prevent ignition of the explosive atmospheres do not separate connectors when energized and an explosive gas mixture is present.

To avoid the risk of explosion due to electrostatic charging of the enclosure, do not handle the units unless the area is known to be safe, or appropriate safety measures are taken to avoid electrostatic discharge.

Liability

To the extent the instructions in this manual are not strictly observed, the customer cannot advance a demand against PR electronics A/S that would otherwise exist according to the concluded sales agreement.

Communication enabler
4511

- Programming display for system 4000 and 9000 devices
- Modbus RTU protocol interface over RS-485
- Monitor process value from the built-in display
- High 2.5 kV isolation to host unit
- Shielded RJ45 Modbus connector on top

Applications

- The 4511 detachable display adds Modbus RTU RS-485 serial communications to all current and future 4000/9000 units.
- The unit converts a wide array of sensors and analog device signals measured by the system 4000, like uni- and bipolar mA and voltage signals, potentiometer, Lin. R, RTD and TC, to a Modbus communication line signal.
- When mounted on a system 9000 device any signal coming from or going to I.S. classified area, like AI, AO, DI and DO signals, can be converted to a Modbus network.
- All individual unit operating parameters can easily and quickly be configured by using the Modbus communication or by using the front display menu.
- The easily readable 4511 display can be used to read the process signal, simulate the output signal, indicate sensor errors and internal module errors.

Technical characteristics

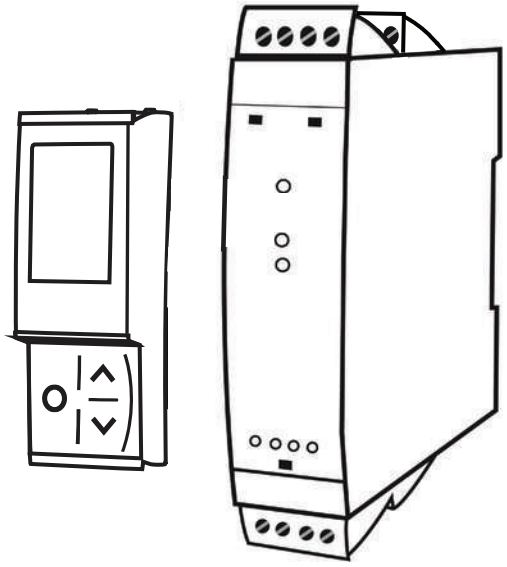
- 4511 has full 4501 functionality for unit programming, process signal monitoring and diagnostics handling.
- Modbus RTU protocol is supported using a serial RS-485 communication wiring.
- Multidrop half-duplex connection via shielded RJ45 connector.
- High safe galvanic isolation of 2.5 kVAC between the serial wiring and the connected system 4000/9000 units.
- Modbus parameters such as address, baud rate, stop bit(s), and parity bit are configured from the 4511 display, which also stores parameters.

Mounting / installation / programming

- Mounting in Zone 2 / Div 2.
- The 4511 can be moved from one device to another. The individual system 4000/9000 unit configuration of the first transmitter can be saved and downloaded to subsequent transmitters.
- Programmed parameters can be protected by a user-defined password.
- When mounted on devices that are installed upside down, a menu item allows the display on the 4511 to be rotated 180° and the up/down buttons to switch function.

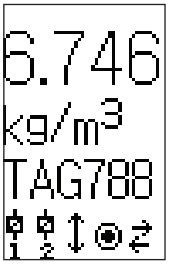
Mounting on a 4000 / 9000 device

4511 is a detachable display that can be mounted on all system 4000/9000 fronts for programming and signal monitoring.



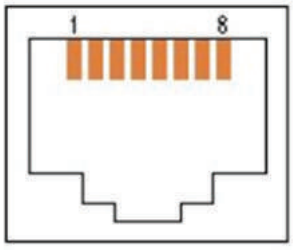
4511 contains a four line LCD dot display

Line 1 can e.g. show the scaled process value.
Line 2 can e.g. show the selected engineering unit.
Line 3 can e.g. show the analog output or TAG no.
Line 4 shows status for communication and e.g. signal trending.



RJ45 Modbus Connector

Pin 5: RS485 A line
Pin 4: RS485 B line
Pin 8: RS485 GND and shield



Order

Type	Description
4511	Communication enabler
4590	Configmate interface
4801	Modbus gateway

Electrical specifications

Environmental conditions:

Specifications range . . . . . -20°C to +60°C
Storage temperature . . . . . -20°C to +85°C
Humidity . . . . . < 95% RH (non-cond.)
Protection degree IP20
Installation in pollution degree 2 / overvoltage category II.

Mechanical specifications:

Dimensions (HxWxD) . . . . . 73.2 x 23.3 x 26.5 mm
Dimensions (HxWxD) w/ 4000/9000 unit . . . . . 109 x 23.5 x 131 mm
Weight approx. . . . . 100 g
Connection . . . . . RJ45 - shielded

Common specifications:

Power consumption . . . . . ≤ 0.15 W
Isolation voltage - test / working . . . . . 2.5 kVAC / 250 VAC reinforced isolation

Extended EMC immunity:	
NAMUR NE 21, A criterion, burst	No loss of communication

Signal / noise ratio . . . . . > 60 dB
Update rate / response time . . . . . > 50 Hz / < 20 ms
Signal type . . . . . RS-485 half duplex
Serial protocol . . . . . Modbus RTU
Modbus mode . . . . . RTU - slave
Devices on an RS485 line . . . . . Up to 32 (without a repeater)
Data rates, baud 2400, 4800, 9600, 19200, 38400, 57600, 115200
Automatic baudrate detection . . . . . Yes - can be configured ON or OFF
Parity . . . . . Even, Odd, None
Stop bit(s) . . . . . 1 or 2
Digital adressing . . . . . 1...247
Response delay . . . . . 0...1000 ms

Approvals:

EMC 2004/108/EC . . . . . EN 61326-1
LVD 2006/95/EC . . . . . EN 61010-1
UL, Standard for Safety . . . . . UL 61010-1

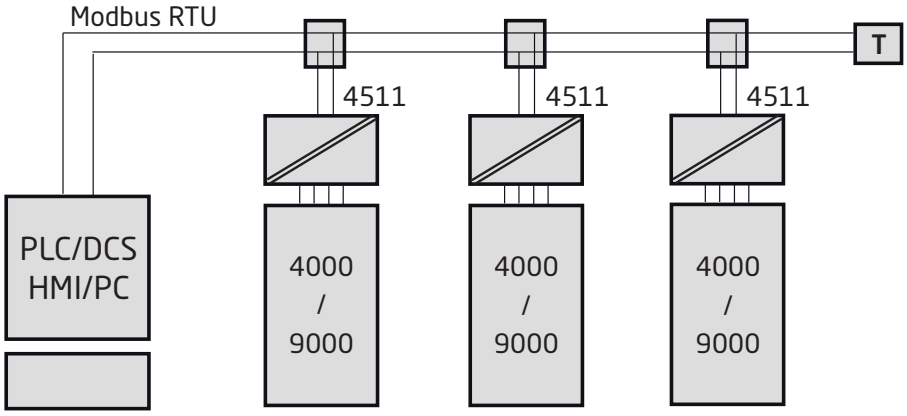
Marine:

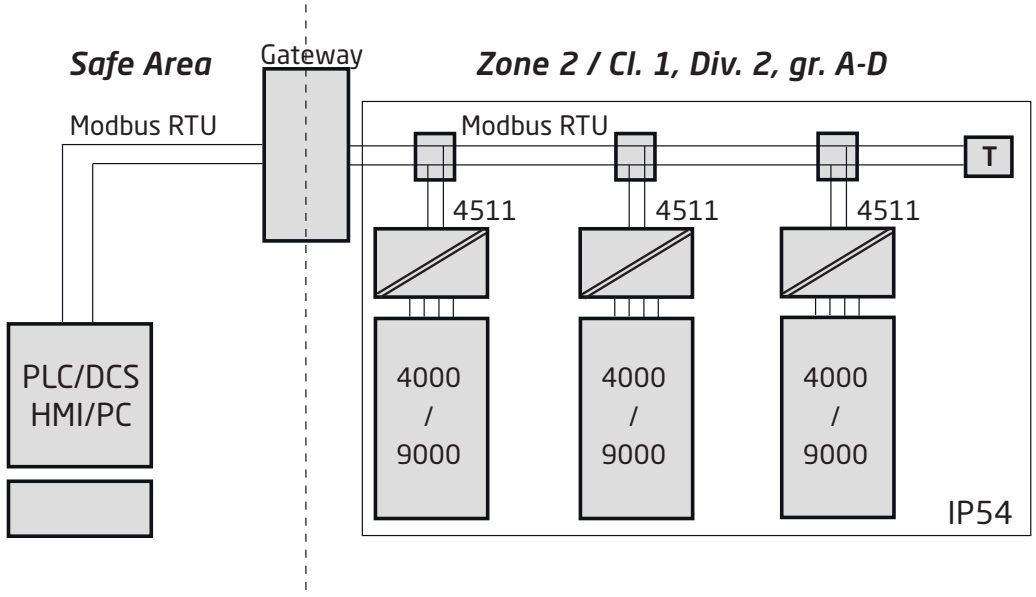
Det Norske Veritas, Ships & Offshore . . . . . Standard for Certification No. 2.4

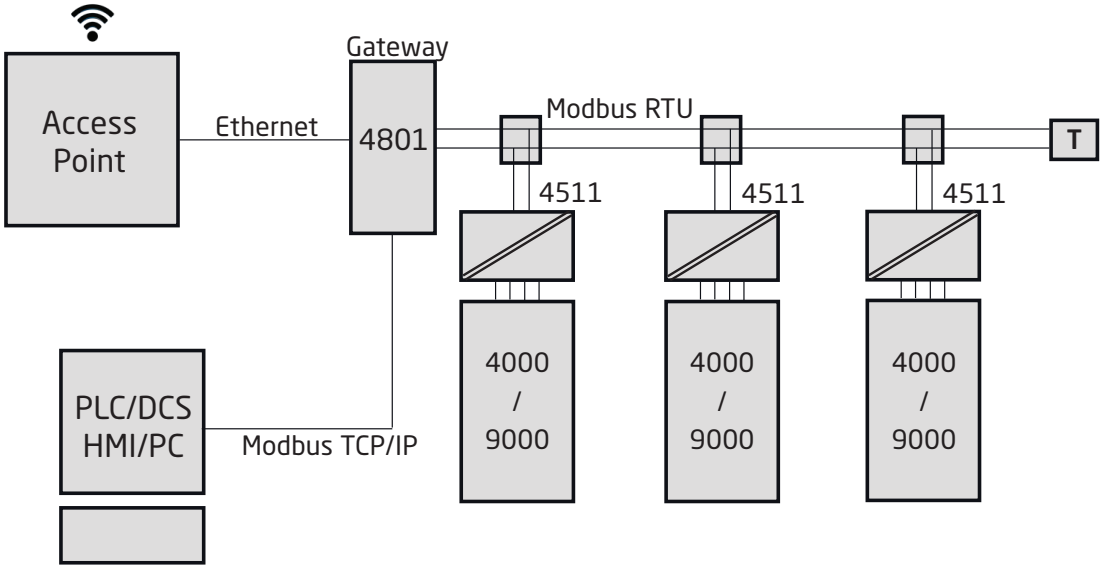
Ex:

ATEX . . . . . DEKRA 13ATEX0098 X
II 3 G Ex nA IIC T5 Gc
IECEx . . . . . DEK 13.0026 X
Ex nA IIC T5 Gc
FM 0003049132-C
CL I DIV2 GP A- D T5
CL I Zn2 Groups IIC T5
CL I Zn2 AEx/Ex nA IIC T5

4511 installation examples







Modbus basics

Modbus is a "master-slave" system..., where the "master" communicates with one or multiple "slaves".

The master typically is a PLC (Programmable Logic Controller), DCS (Distributed Control System), HMI (Human Machine Interface), RTU (Remote Terminal Unit) or PC.

The three most common Modbus versions used are: MODBUS ASCII, MODBUS RTU and MODBUS/TCP.

In Modbus RTU, data is coded in binary, and requires only one communication byte per data byte. This is ideal for use over multi-drop RS485 networks, at speeds up to 115,200 bps.

The most common speeds are 9,600 bps and 19,200 bps.

Modbus RTU is the most widely used industrial protocol and is supported by the 4511.

Modbus RTU:

To communicate with a slave device, the master sends a message containing:

Device Address - Function Code - Data - Error Check

The Device Address is a number from 0 to 247.

Messages sent to address 0 (broadcast messages) will be accepted by all slaves, but numbers 1-247 are addresses of specific devices.

With the exception of broadcast messages, a slave device always responds to a Modbus message so the master knows the message was received.

4511 Supported Modbus Function Codes:

Command	Function code
Read Holding Registers	03
Read Input Registers	04
Write Single Register	06
Diagnostics	08
Write Multiple Registers	16

The Function Code defines the command that the slave device is to execute, such as read data, accept data, report status. Some function codes have subfunction codes.

The Data defines addresses in the device's memory map for read functions, contains data values to be written into the device's memory, or contains other information needed to carry out the function requested.

The Error Check is a 16-bit numeric value representing the Cyclic Redundancy Check (CRC).

Maximum number of registers which can be read or written at once:

For a read command, the limit is 8 registers at a baud rate up to 38,400 bps, 16 registers @ 57,800 bps and 32 registers @ 115,200 bps.

For a write command, the limit is 123 registers at baud rates up to 115,200 bps.

4511 Modbus parameter settings

Automatic Baudrate Detection:

Can be configured YES or **NO**

Supported baudrates:

2400, 4800, 9600, **19.2k**, 38.4k, 57.6k, 115.2k bps

Parity Mode:

Even, Odd or None parity

Stop Bits:

1 or 2 stop bits

Response delay:

0...1000 ms **(0 ms = default)**

Modbus slave addressing range:

1 - 247 **(247 = default address)**

Modbus Parameter Storage:

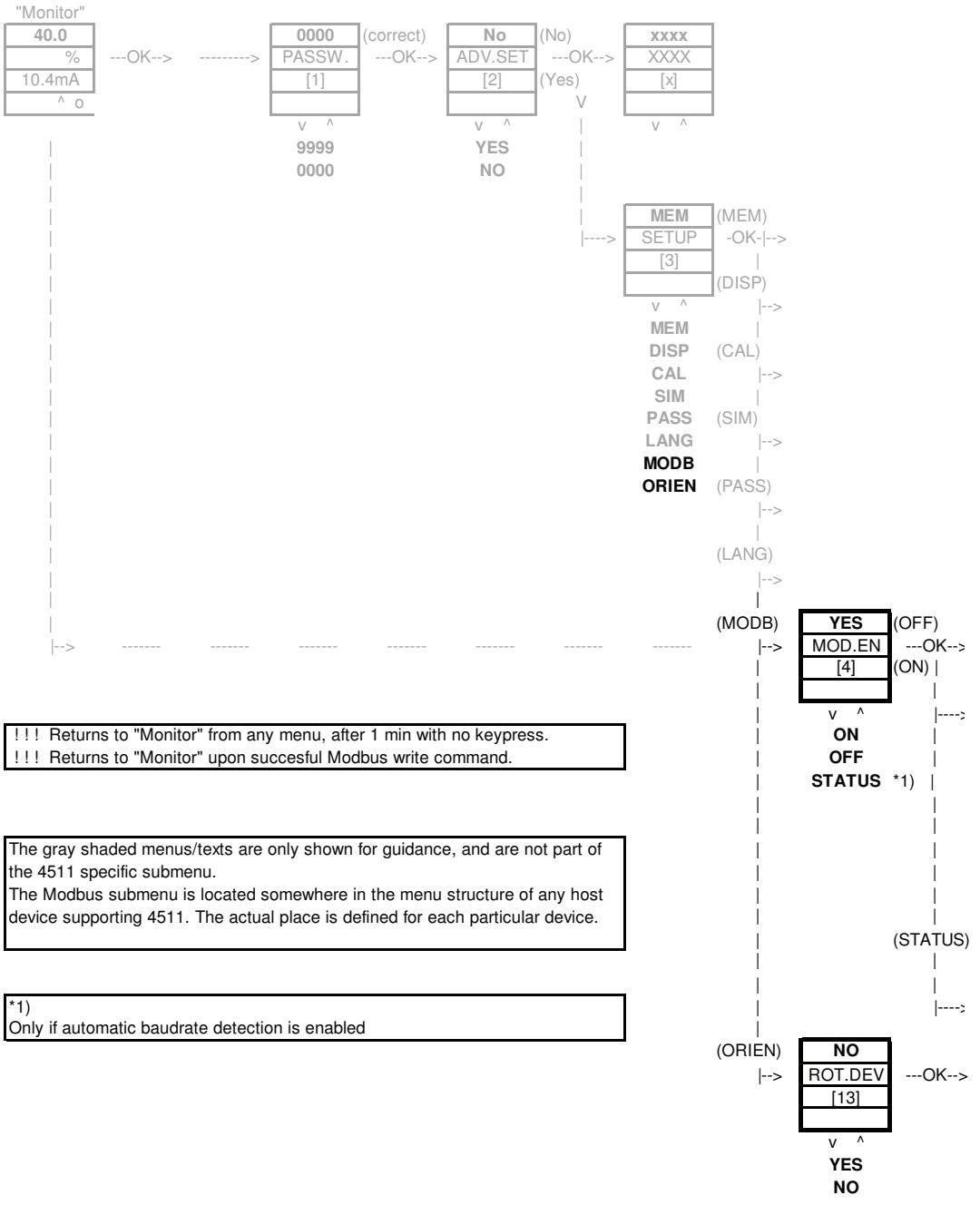
Saved in non-volatile memory in the 4511 device

(Factory Default Values are marked in **bold**)

Modbus RTU segment line termination:

A 120 Ohm resistor should be installed on both ends of a RS485 Modbus RTU segment loop to prevent signal echoes from corrupting data on the line.

4511 Modbus settings - routing diagram



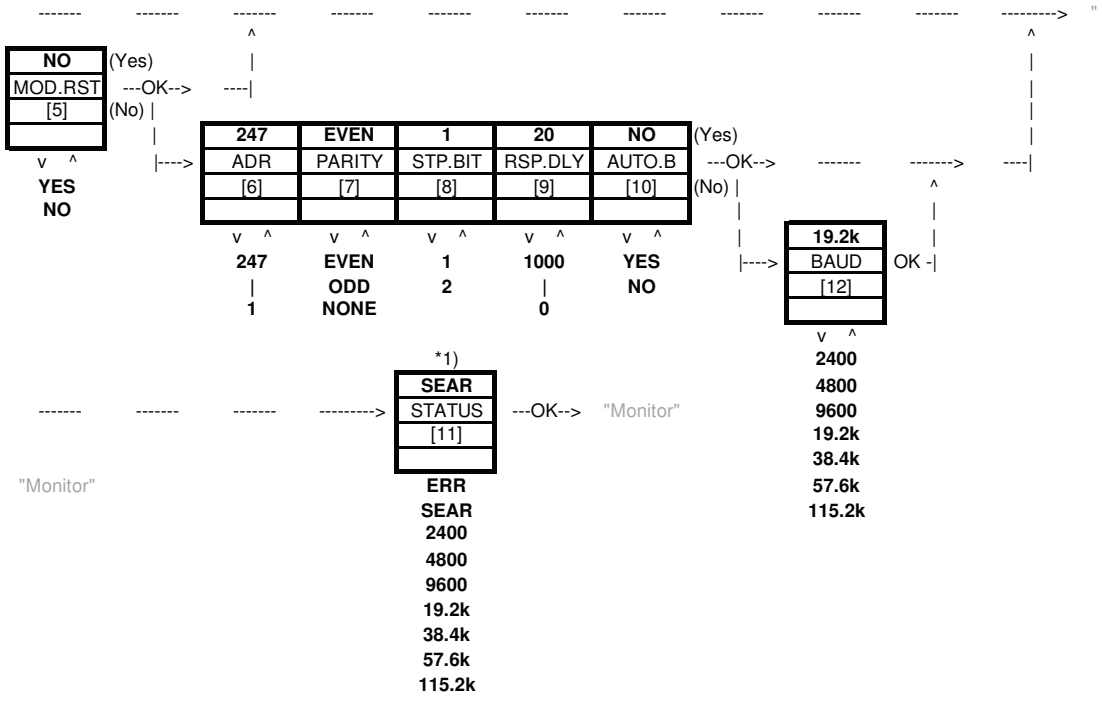
! ! ! Returns to "Monitor" from any menu, after 1 min with no keypress.
! ! ! Returns to "Monitor" upon succesful Modbus write command.

The gray shaded menus/texts are only shown for guidance, and are not part of the 4511 specific submenu.
The Modbus submenu is located somewhere in the menu structure of any host device supporting 4511. The actual place is defined for each particular device.

*1)
Only if automatic baudrate detection is enabled

SCROLLING HELPTEXTS:

[1] Set correct password
[2] Enter advanced setup menu?
[3] Enter Language setup
Enter Password setup
Enter Simulation mode
Perform Process calibration
Enter Display setup
Perform Memory operations
Enter Modbus setup
Enter Rotation setup
[4] Enable modbus communication
Disable Modbus communication
See automatic baudrate detection status
[5] Reset Modbus to default?
[6] Select Modbus slave address
[7] Select parity for Modbus
[8] Select number of stop bits
[9] Select response delay in ms
[10] Enable automatic baudrate detection
[11] Modbus baudrate not detected
Searching for Modbus baudrate
Modbus baudrate detected
[12] Select baudrate in bps
[13] Rotate device upside down?



Default settings:

Baud rate:	19.2 kbps
Parity mode:	Even
Stop bit:	1
Address:	247
Reponse delay:	0 ms

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