DIGITAL INSTRUMENTS FOR INSTALLATION ON DIN SLOT

S504 Series

TECHNICAL MANUAL

CE

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Company with quality system certified to UNI EN ISO 9001-2000

WARNINGS

This manual is dedicated to the technical personnel responsible of the installation, management and maintenance of the plants. The manufacturer assumes no responsibility for damages or malfunctions occurring after intervention by non-authorized personnel, or not compliant with the prescribed instructions.

Before performing any maintenance or repair action, ensure that the system is electrically and hydraulically insulated.

Dispose of waste material and consumables accordingly with local regulations.

The manufacturer can modify the instrument or the technical manual without advanced notice.

WARRANTY

All our products are warranted for a period of 12 months from the delivery date.

Warranty is not valid if all instructions of installation, maintenance and use, are not strictly followed by the user. Local regulations and applicable standards have also to be followed.

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PACKING LIST

1. The S504 controller, complete with removable terminal blocks
2. Technical manual
3. Ferrites (2 pcs. – part no. 5062.0020)

INTRODUCTION AND PRINCIPLE OF OPERATION

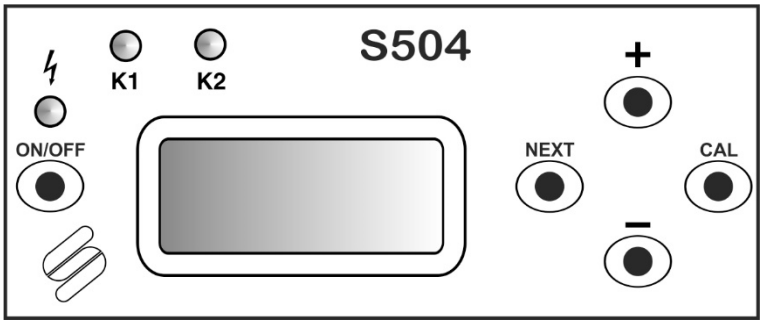
The S504 instruments are digital microprocessor-based units, designed for installation on DIN slot.
All models feature two relay outputs (configurable as control thresholds or alarms), a current (mA) output fully configurable and galvanically isolated. All outputs may be temporarily disabled (e.g. for maintenance) using the ON/OFF button. Alarms and errors (diagnostics) are directly shown on display, and configuration / calibration data are stored into the non-volatile internal memory for at least 10 years.

The S504 series includes models with different analogic input, for the following measurement sensors:
- ✓ pH / ORP electrode
- ✓ Two-electrode conductivity cell
- ✓ Indicator with 0/4-20 mA input (standardized input)

Moreover, all models are equipped with input for PT100 sensor, for temperature measurement and thermo-compensation of pH and conductivity readings.

Warning! This instrument has been designed to be installed inside an electrical cabinet. Never use the instrument if it is not correctly mounted and wired!

DESCRIPTION OF THE FRONT PANEL



ON/OFF key	Enable / disable output relays
CAL key	Allow to enter configuration and calibration modes
[+] key	While in normal mode, show the "GAIN" value (amplification factor); in calibration mode increase the displayed value
[-] key	While in normal mode, show the "OFFSET" value (deviation from zero); in calibration mode decrease the displayed value
NEXT key	While in normal mode, toggle between main measure and temperature readings; in calibration mode exit without saving the new calibration data
LED K1	LED ON = K1 relay ON = contact closed
LED K2	LED ON = K2 relay ON = contact closed
LED ON	Light ON (fix) means instrument ON and no anomalies; blinking light indicates malfunction or outputs disabled through the ON button
Display	While in normal operation mode, displays measurement and temperature value. If no temperature probe is connected, shows the value set in parameter P04, within brackets.

TECHNICAL DATA

Common characteristics

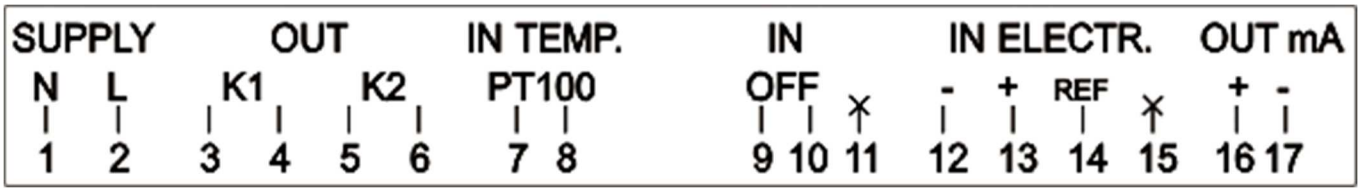
Power supply	10-240 V~ 50/60 Hz (24V- or 24V~ upon request)	
Power consumption	max 4 VA	
Power supply protection	internal PTC fuse	
Display	alphanumeric display, 2 rows x 8 characters, with backlight	
Analogue inputs	precision better than 0.3% FS ; repeatability better than 0.2% FS (electronics only)	
Temperature input	available on all versions; removable, 2-pin terminal block for connection of a Pt100 sensor	
Digital input	OFF input for output disabling; accept a voltage free contact (5V supply on terminals, 5 mA max current)	
Digital outputs	2 independent relay outputs on removable, 4-pin terminal block; contact max load: 250 V~ , 3 A resistive	
Current output	0/4-20 mA (selectable through software), 400 Ω max load, 0.5% FS max error; galvanic insulation from inputs	
Environment	Storage temperature	-20 to +60 °C
	Working temperature	-10 to +50 °C
	RH	max 90% noncondensing
Protection rate	IP20	
Casing	6 modules, DIN43880 standard, for installation on DIN slot	
Dimensions	105 x 90 x h 73 mm	
Weight	approx. 350 g	

Analogic input, depending on model

pH / ORP	available on removable, 4-pin terminal block for coaxial cable + reference; input impedance > 10^12 Ω
Conductivity	available on removable terminal block, for connection of a 2-electrode cell with shield
Standardized input	available on removable, 4-pin terminal block (specify input type, measure range and transducer voltage upon order)

ELECTRICAL CONNECTIONS

For electrical connections, always refer to the label attached on the terminal block.



Anyway, the electrical connections of the measure input depend on the instrument model. The following indications are the common connections for all models:

- SUPPLY: pins 1 and 2; the mains power supply must correspond to the instrument voltage (±10%); see instrument label. The instrument is equipped with an internal protection system, thanks to which it is not necessary to enforce any polarity in the case of DC power.
- OUT K1, K2: pins 3 and 4 are used for relay K1; pins 5 and 6 are dedicated to relay K2.
- IN TEMP. PT100: pins 7 and 8 for connecting a Pt100 sensor; in case of long connections (longer than 5 meters) it is recommended to use a 2-wire shielded cable, and the shield has to be connected to the pin 8.
- IN OFF: pins 9, 10 and 11; voltage free contact to be connected to pins 9 and 10. When the contact closes, after a set delay, all outputs are disabled and an error message is displayed.
- IN ELECTR. : measure input, pins 12, 13, 14 and 15; see specific sections.
- OUT mA: current output, pins 8 (positive) and 9 (negative).

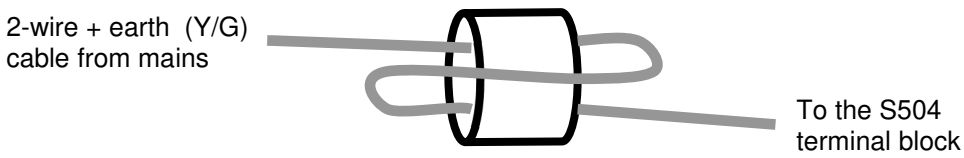
Before performing any intervention, ensure that the instrument is not powered!

Notes:

- *The relay output contacts are not protected. A fuse or similar protection system must be installed.*
- *In case of inductive loads the outputs have to be protected with proper systems for the suppression of arches and interferences (RC networks or varistors for AC voltage, diodes or varistors for DC voltage).*

To obtain a good performance of the device even in noisy environments, it is recommended to follow the below instructions:

a) Insert a ferrite (code 5062.0020) into the power cable as shown in the picture below
b) Connect the metallic shield of the signal cable to the system grounding or to the REF terminal
c) Insert a ferrite (code 5062.0020) into the input signal cables as shown in the picture below
d) Connect proper RC suppressors (or equivalent) in parallel with the load
e) The electrical cabinet containing the instrument should be correctly grounded
f) If the analogue cable connected to the current output is longer than 20 m, perform the cable shield grounding (or connection to the REF terminal)
g) Perform one or two turns (if the section of the cable allows it) around the ferrite



Ferrite 5062.0020

Make one or two turns (if the cable section allows it) around the ferrite.

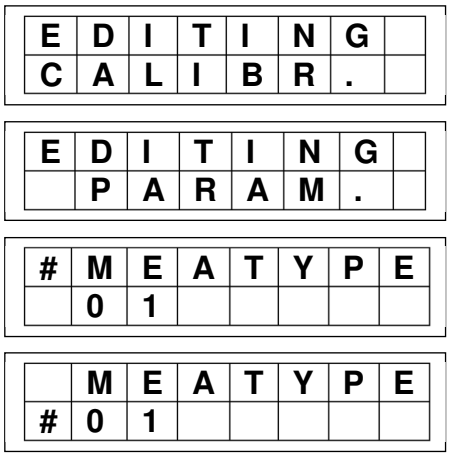
Note: *The instrument is supplied with two ferrites, one for the power cable and one for the input signal cable. In the case of a second input (temperature) with separate cable from that of the main input, order a third ferrite.*

START-UP

At start-up, the S504 displays the instrument/software version, then checks the status of memorized data and shows any error or warning messages (see the “Errors” section for details), then the controller enters the normal mode, displays the measurement value and upgrades the output status.
Pressing simultaneously the [+] and [-] keys at start-up, the S504 runs a “Test” program: the display shows “0” and the LED ON blinks. This value simulates the measurement and can be incremented or decremented with the [+] and [-] keys. The “Test” program allows to check the functioning and configuration of the current and relay outputs.

CONFIGURATION

This section describes the procedure for configuring the editable parameters through front keyboard.



1) Press and hold CAL for at least 2 seconds to enter the configuration/calibration mode.
2) Press and hold the NEXT key to enter the configuration mode.
3) Release the NEXT key and the display shows the first editable parameter.
4) The # cursor blinks to indicate that the value can be increased and/or decreased by pressing the [+] / [-] key.
5) Press CAL to move the cursor and then modify the parameter value.
6) Adjust the value using the [+] / [-] keys.
7) Press CAL to confirm, or NEXT to exit without saving the modification.
8) If the modification is confirmed by pressing CAL, the meter automatically shows the next editable parameter.
9) Repeat the same procedure for all the parameters.
10) Press NEXT to exit the configuration mode and resume normal operation.

Notes:

- *If no key is pressed, after a few seconds the instrument automatically exits the configuration mode.*
- *If the configuration mode is protected by password, the instrument asks this password before entering the mode.*

LIST OF PARAMETERS

It is recommended to fill the last column with the values set for your application.

Version pH / RX / °C / mA (factory values refer to pH range)

PAR.	Description	Min value	Max value	Default value	Set value
P01	Measure type	0	2	0	
P02	Reserved	0.00	0.00	0.00	
P03	Reserved	0	1	0	
P04	Working temperature	0	100	25 °C	
P05	K1 working mode	0	2	1	
P06	Min threshold of relay K1	-1000	2000	6.00 pH	
P07	Max threshold of relay K1	-1000	2000	6.30 pH	
P08	Energizing delay of K1	0	120	0 sec	
P09	De-energizing delay of K1	0	120	0 sec	
P10	K2 working mode	0	4	1	
P11	Min threshold of relay K2	-1000	2000	6.50 pH	
P12	Max threshold of relay K2	-1000	2000	6.80 pH	
P13	Energizing delay of K2	0	120	0 sec	
P14	De-energizing delay of K2	0	120	0 sec	
P15	Delay at start-up	0	60	0 min	
P16	Current output type	0	1	1	
P17	Starting value of current output	-1000	2000	0.00 pH	
P18	Full scale value of current output	-1000	2000	14.00 pH	
P19	Current output fault value	0.0	21.0	21.0 mA	
P20	Password	0	999	0	
P21	Auto set	0	100	0	
(P22)	Measurement 1 starting value (mA only)	-1000	2000	0	
(P23)	Measurement 1 full scale value (mA only)	-1000	2000	2000	
(P24)	Decimal point position + measure unit for measurement 1 (mA model only)	0	51	0	

Version conductivity meter

PAR.	Description	Min value	Max value	Default value	Set value
P01	Conductivity meter type	0	25	23	
P02	Temperature compensation coefficient	0.00	4.00	2.00	
P03	Reference temperature	0	100	25 °C	
P04	Working temperature	0	100	25 °C	
P05	K1 working mode	0	2	1	
P06	Min threshold of relay K1	-1000	2000	70.0 µS	
P07	Max threshold of relay K1	-1000	2000	80.0 µS	
P08	Energizing delay of K1	0	120	0 sec	
P09	De-energizing delay of K1	0	120	0 sec	
P10	K2 working mode	0	4	1	
P11	Min threshold of relay K2	-1000	2000	85.0 µS	
P12	Max threshold of relay K2	-1000	2000	95.0 µS	
P13	Energizing delay of K2	0	120	0 sec	
P14	De-energizing delay of K2	0	120	0 sec	
P15	Delay at start-up	0	60	0 min	
P16	Current output type	0	60	0 min	
P17	Starting value of current output	-1000	2000	-1000	
P18	Full scale value of current output	-1000	2000	-1000	
P19	Current output fault value	0.0	21.0	0.0	
P20	Password	0	999	0	
P21	Auto set	0	100	0	

MEANING OF PARAMETERS

PARAMETER 01 (**pH** / **RX** / **T**) **MEASURE TYPE**

The S504-pH/RX/T is generally supplied already set as pH-meter. Anyway, the user can easily change this selection as follows: 0 = pH-meter; 1 = redox meter; 2 = thermometer.

PARAMETER 01 (**conductivity**) **CONDUCTIVITY METER TYPE**

Select the desired combination of measure range/cell constant and set this parameter accordingly. See below table for details:

Cell constant	Range	P01	Range	P01	Range	P01	Range	P01
K = 10cm	2µS/cm	1	20µS/cm	2	200µS/cm	3	2000µS/cm	4
K = 1cm	20µS/cm	6	200µS/cm	7	2000µS/cm	8	20mS/cm	9
K = 0.1cm	200µS/cm	11	2000µS/cm	12	20mS/cm	13	200mS/cm	14
K = 0.01cm	2000µS/cm	16	20mS/cm	17	200mS/cm	18	2000mS/cm	19
K = 5cm	2µS/cm	21	20µS/cm	22	200µS/cm	23	2000µS/cm	24

If P01 is set with a value not included in this table, conductivity measurements will be not reliable.

PARAMETER 01 (**mA input**) **MEASURE TYPE**

This parameter allows to choose the standardized input type as follows: 0= 0-20 mA; 1 = 4-20 mA.

PARAMETER 02 (**pH/RX/T** / **mA input**) **RESERVED**

Reserved for future use.

PARAMETER 02 (**conductivity**) **TEMPERATURE COMPENSATION COEFFICIENT**

Temperature compensation is calculated as follows:

$$C(T) = C(T_{ref}) \times \left(1 + \frac{\alpha T}{100} \times (T - T_{ref})\right)$$

Where: T = current temperature value (°C)
T_{ref} = reference temperature (typically 25°C, or value set in parameter P03)
αT = temperature compensation coefficient, in %/°C (P02)

The typical temperature compensation coefficient is αT=2.00%/°C. Typical αT values depend on the solution:
Acid: 1.0 to 1.6 %/°C
Alkali: 1.8 to 2.2 %/°C
Salt: 2.2 to 3.0 %/°C
Water: approx. 2.0 %/°C

The αT coefficient is not strictly constant over the whole range of thermo-compensation, but for small temperature variations (e.g. 20-50°C) it can be considered constant. Setting this coefficient to 0 means no temperature compensation.
If the αT value is unknown, it can be calculated as follows:

1) Set αT (P02) to 0.00 (no temperature compensation)
2) Read the conductivity value of the liquid at the reference temperature (e.g. 25°C)
3) Bring the liquid at the working temperature
4) Read the conductivity value at the working temperature
5) Calculate the αT (P02) coefficient with the following formula:

$$\alpha T = \frac{C(T) - C(T_{ref})}{T - T_{ref}} \times \frac{100}{C(T_{ref})}$$

6) Enter the calculated coefficient in the parameter P02

PARAMETER 03 (**pH/RX/T** / **mA input**) **RESERVED**

Reserved for future use.

PARAMETER 03 (**conductivity**) **REFERENCE TEMPERATURE**

See Parameter 02

PARAMETER 04 WORKING TEMPERATURE

All S504 models can measure the temperature and use the value for temperature compensation of measurements. If no Pt100 sensor is connected, this parameter allows to enter the working temperature value, which is displayed in brackets.

PARAMETER 05 K1 WORKING MODE

The K1 relay output features 3 different working modes, coded as follows:

0 = the relay is disabled (always OFF)
1 = the contact is closed when the set thresholds are exceeded
2 = the contact is open when the set thresholds are exceeded

PARAMETER 06 MIN THRESHOLD OF RELAY K1

Minimum threshold for the intervention of relay K1, accordingly with the above indications.

PARAMETER 07 MAX THRESHOLD OF RELAY K1

Maximum threshold for the intervention of relay K1, accordingly with the above indications.

PARAMETER 08 ENERGIZING DELAY OF RELAY K1

If the relay K1 is configured for working mode 1 or 2, this parameter allows to enter a delay (in seconds) for its activation. Setting P08 to zero excludes the delay (immediate activation of the relay).

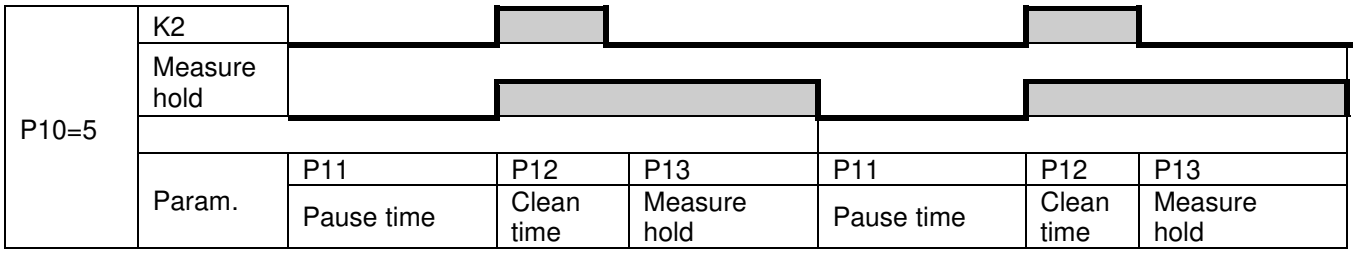
PARAMETER 09 DE-ENERGIZING DELAY OF RELAY K1

Same as parameter 09, but referred to the relay de-activation.

PARAMETER 10 K2 WORKING MODE

The K2 relay output features 6 different working modes, coded as follows:

0 = the relay is disabled (always OFF)
1 = the contact is closed when the set thresholds are exceeded
2 = the contact is open when the set thresholds are exceeded
3 = NC (normally closed) alarm, i.e. the contact K2 is closed when measurement is within the set thresholds (P11 & P12).
4 = NO (normally open) alarm, i.e. the contact K2 is open when measurement is within the set thresholds (P11 & P12).
5 = automatic cleaning cycle, i.e. at preset intervals, the instrument freezes the measurement, activates the K2 relay (to which, for example, a solenoid valve is connected, that regulates the dosage of detergent) for a set time; then deactivates K2 and keeps the measurement frozen for the time necessary to complete the wash; finally it resumes to normal operation.



PARAMETER 11 MIN THRESHOLD OF RELAY K2

This is the minimum threshold for the activation of relay K2, or the pause time between two subsequent cleanings as explained above.

PARAMETER 12 MAX THRESHOLD OF RELAY K2

This is the maximum threshold for the activation of relay K2, or the cleaning time as explained above.

PARAMETER 13 ENERGIZING DELAY OF RELAY K2

This parameter allows to enter a delay time (in seconds) for the activation of relay K2, or the measurement hold time (in seconds) after a cleaning action.

PARAMETER 14 DE-ENERGIZING DELAY OF RELAY K2

This parameter allows to enter a delay time (in seconds) for the de-activation of relay K2.

PARAMETER 15 DELAY AT START-UP

At start-up, the sensor connected to the signal input could need a stabilization time before giving correct measurements. For example, this is a typical behavior for the redox electrodes immersed in oxidized solution. If no delay is set, during stabilization the instrument activates the outputs depending on the measured value and can, therefore, perform erroneous actions due to unstable readings.
This parameter allows to enter a correct delay (in minutes) to keep the instrument in stand-by during measurement stabilization. If the parameter is set to zero, this function is disabled.

PARAMETER 16 CURRENT OUTPUT TYPE

This parameter allows to enter the desired mA range for the current output: 0 = 0-20 mA ; 1 = 4-20 mA.
Note: The declared precision of the current output applies to values greater than approx. 0.3 mA, while at the beginning of the 0-20 mA the precision is decreased at 1.5%.

PARAMETER 17 STARTING VALUE OF CURRENT OUTPUT

This parameter is used to set the measurement value to which corresponds the starting point of the current output (0 or 4 mA depending on the configuration of the parameter P16).
For example, in the case of pH measurement and P16=1, to obtain 4 mA at 3.50 pH, set P17 to 3.50.

PARAMETER 18 FULL SCALE VALUE OF CURRENT OUTPUT

This parameter is used to set the measure value to which corresponds the full scale value of the current output (20 mA). For example, in case of pH measurement, to obtain 20 mA at 8.40 pH, set P18 to 8.40.

PARAMETER 19 FAULT VALUE OF CURRENT OUTPUT

This parameter allows to set the fault value of the current output (e.g. over-range error, measurement disabled by the OFF input, ON/OFF key pressed, etc.).

PARAMETER 20 PASSWORD

To protect the access to the configuration menu with a password and prevent undesired modification by non-authorized personnel, enter a value different from zero in this parameter.
Warning! If the password is forgot, there is no way to access the configuration menu! The instrument has to be sent to the manufacturer for a complete re-configuration!

PARAMETER 21 AUTO SET

This parameter allows to restore all default values for the configuration parameters (P01 to P20). This operation can be useful when unreliable values have been entered. To activate the reset operation, enter “12”. When the AUTOSET is completed, the instrument displays a message to inform the user.

(PARAMETER 22) MEASUREMENT 1 STARTING VALUE

This parameter is available for models with mA input and represents the displayed value correspondent to the starting value of the current output span (0 or 4 mA). Normally this parameter is factory set accordingly with customer indications. Do not attempt to modify this value!

(PARAMETER 23) MEASUREMENT 1 FULL SCALE VALUE

This parameter is available for models with mA input and represents the displayed value correspondent to the full scale value of the current output span (20 mA). This parameter is factory set accordingly with customer indications. Do not attempt to modify this value!

(PARAMETER 24) DECIMAL POINT POSITION AND MEASURE UNIT FOR MEAS.1

This parameter is available for models with mA input and allows to set the decimal point position on display and the desired measure unit, accordingly with the following formula:
P24 = (Measure unit code x 8) + Decimal point position
Note: Normally this parameter is factory set accordingly with customer indications. Do not attempt to modify this value!

Codified measure unit are listed in the table below:

0 =	1 = pH	2 = mV	3 = °C	4 = ppm	5 = uS	6 = mS	7 = %	8 = mA
9 = pulse	10 = sec	11 = min	12 = %/°C	13 = V	14=mbar	15 = bar	16 = cm	17 = m
18 = FTU	19 = NTU	20 = l/h	21 = m^3/h					

Example: 4-20 mA input from remote conductivity meter with measure range 0…50.0 mS/cm:
P1 = 1 ; P22 = 0 ; P23 = 500 ; P24 = (6x8)+1 = 49

CONTROL EXAMPLES

Here below are listed some typical configuration examples for the control parameters:

1) S504 pH/RX version; control of the acidification to obtain a pH level of 7.40 :
   MEASURE TYPE = 0 (pH-meter) (P01 = 0)
   K1 WORKING MODE = 1 (relay closes when max threshold is exceeded) (P05 = 1)
   It is recommended to set a quite narrow hysteresis window, for example:
   MIN THRESHOLD = 7.30 pH (P06 = 7.30 pH)
   MAX THRESHOLD = 7.50 pH (P07 = 7.50 pH)
   In this condition the relay K1 is energized (and activates the acidification) when the pH level is greater than 7.50, and de-energizes as soon as the pH level falls below 7.30.
   The relay K2 can be used as an alarm threshold:
   K2 WORKING MODE = 3 (NC alarm) (P10 = 3)
   MIN THRESHOLD = 6.50 pH (P11 = 6.50 pH)
   MAX THRESHOLD = 8.50 pH (P12 = 8.50 pH)

2) Check the conductivity of the water coming out from a demineralization plant, and generate an alarm (or trigger a resin regeneration cycle) when the conductivity level is greater than 12.00 µS/cm. Set the conductivity range and K1 parameters as follows:
   CONDUCTIVITY METER TYPE = 22 (19.99 µS/cm, K = 5 cm) (P01 = 22)
   K1 WORKING MODE = 1 (relay closes when threshold is exceeded) (P05 = 1)
   MIN THRESHOLD = 12.00 µS/cm (P07 = 12.00 µS/cm)
   ENERGIZING DELAY = 60 sec (P08 = 60 sec)
   DE-ENERGIZING DELAY = 0 sec (P09 = 0 sec)
   In this condition the relay K1 is energized (generating an alarm or triggering a regeneration cycle) as soon as the conductivity level exceeds the 12.00 µS/cm threshold for at least 1 minute (60 sec). This delay avoids erroneous commands due to interferences or momentary peaks.

TEMPERATURE COMPENSATION

The temperature compensation of pH and conductivity measurements is performed using the temperature read through the temperature input. If no temperature probe is connected, the S504 uses - as working temperature - the value set in the parameter P04.

ADDITIONAL VISUALIZATIONS

Pressing the [-] and [+] keys during the normal operations will result in the following displaying:

pH-meter	[+]	gain factor (0.667 ... 1.428)
	[-]	offset in pH units @25°C (-1.50 ... 1.50)
Redox-meter	[+]	gain factor (1.000) - fix
	[-]	offset in mV (-150 ... 150)
Thermometer	[+]	gain factor (0.900 … 1.100)
	[-]	offset in °C (-5.0 … +5.0°C)
Conductivity meter	[+]	gain factor (0.750 ... 1.500)
	[-]	offset in points (-100 ... 100)
Std. input	[+]	gain factor (0.500 ... 2.000)
	[-]	offset in points (-200 ... 200)

***Note**: With the factory calibration these values are set as following: OFFSET = 0 , GAIN = 1.000.*

ERRORS

Each error or anomaly detected by the controller generates a warning message on the display, the blinking LED ON and the fault value (P19) at the current output. Error messages are listed here below.

WARNING 01 : K1 DISABLED
No working mode has been set for output K1, but the instrument continues its normal operations.

WARNING 02 : K2 DISABLED
No working mode has been set for output K2, but the instrument continues its normal operations.

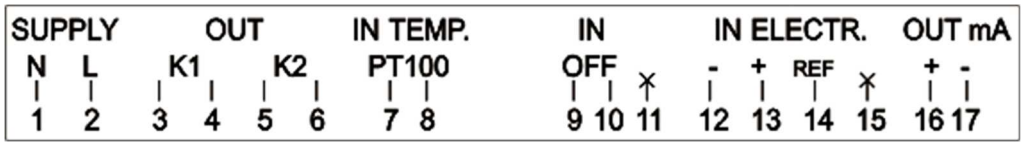
ERROR 02 : mA OUTPUT ERROR
The mA output range has been set with min and max thresholds too close (P17 and P18). In this condition the mA output does not work properly. Re-set parameters P17 and P18.

CALIBRATION ERROR!
Calibration cannot be completed successfully (for example pH offset calibration with electrode immersed in pH4 buffer solution). Repeat the procedure and carefully check electrode, cable and calibration solutions.

OFF LIV. FLOW
Missing consent at the related input (terminals 9, 10 and 11) . This input is typically connected to a level or flow control. Restore level or flow. When this error is active, all outputs are disabled.

UR / OR : Under / Over Range
The input signal is lower / greater than the minimum / maximum measurement limit for the instrument. Check the sensor connected to the input and the connection cable. When this error is active, all outputs are disabled.

SPECIFICATIONS OF pH INPUT



ELECTRICAL CONNECTIONS

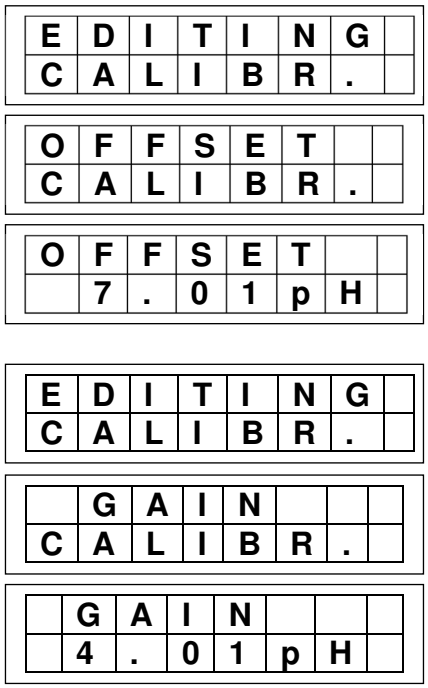
The signal comes from the electrode through a coaxial cable, with a maximum recommended length of 20 meters (for longer cables, please contact the manufacturer).
The electrode input is available on terminals 12 and 13: connect the shield to the pin 12 and the core of the coaxial cable to the pin 13 (***Note****: remove any black conductive plastic between the core and shield of the cable*).
If separated measure and reference electrodes are used, connect reference electrode to pin 14 (REF).
The Pt100 temperature sensor input is available on terminals 7 and 8. Immerse the Pt100 probe into the liquid to be tested, close to the electrode or anyway at the same temperature. If a 3-wire sensor I used, connect the 2 wires of the same color to the same terminal (the wires are internally short circuited).

Caution! Always keep signal cables away from power cable!

ELECTROCHEMICAL CALIBRATION

Before starting this procedure, ensure to have fresh buffer solutions (not expired). If temperature compensation is used, immerse the Pt100 probe into the buffer solutions together with the measure electrode.

1. Rinse the electrode with distilled water.
2. Immerse the electrode in pH 7.01 buffer solution.
3. Press and hold the CAL key for at least 2 seconds to enter the calibration mode.
4. Press [-] and the “OFFSET” message is displayed.
5. Release the button and the display will show the buffer pH value, automatically recognized.
6. If necessary, adjust the value using the [+] or [-] key.
7. Press CAL to confirm the calibration, or press NEXT to exit without saving (previous calibration data are kept).
8. Rinse the electrode with distilled water.
9. Immerse the electrode in pH 4.01 (or pH 9.01) buffer solution.
10. Press and hold the CAL key for at least 2 seconds to enter the calibration mode.
11. Press [+] and the “GAIN” message is displayed.
12. Release the button and the display will show the buffer pH value, automatically recognized.
13. If necessary, adjust the value using the [+] or [-] key.
14. Press CAL to confirm the calibration, or press NEXT to exit without saving (previous calibration data are kept).

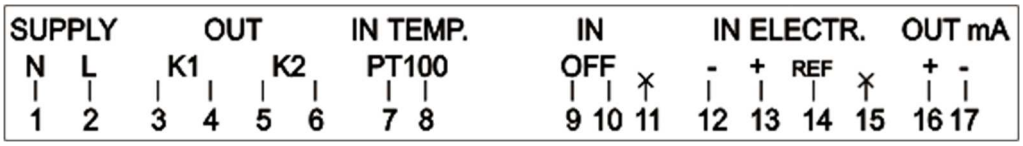


The instrument does not automatically recognizes the buffer pH values whenever:

a) The buffer solution is contaminated dirty or expired
b) The electrode is not working properly or it is exhausted
c) The electrode connection cable is damaged

Note: *If you attempt to calibrate the offset at a pH value too different from pH 7, or to calibrate the gain with a buffer solution too close to pH neutrality, the instrument shows the <<**Cal error!**>> message and does not save the calibration data.*

SPECIFICATIONS FOR ORP INPUT



ELECTRICAL CONNECTIONS

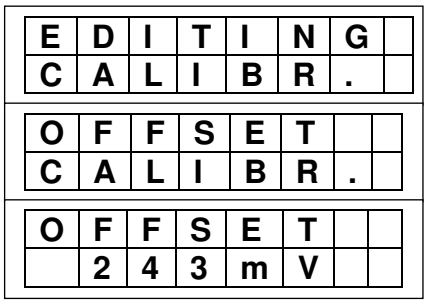
The signal comes from the electrode through a coaxial cable, with a maximum recommended length of 20 meters (for longer cables, please contact the manufacturer).
The electrode input is available on terminals 12 and 13: connect the shield to the pin 12 and the core of the coaxial cable to the pin 13 (***Note****: remove any black conductive plastic between the core and shield of the cable*).
If separated measure and reference electrodes are used, connect reference electrode to pin 14 (REF).
If temperature measurement is also required, connect a Pt100 temperature sensor to terminals 7 and 8.
If a 3-wire Pt100 sensor is used, connect the 2 wires of the same colour at the same terminal (the wires are internally short circuited).

Caution! Always keep signal cables away from power cable!

ELECTROCHEMICAL CALIBRATION

Before starting the procedure, check to have a fresh calibration solution (not expired).

1. Rinse the electrode with distilled water.
2. Immerse the electrode into a calibration solution of known value (e.g. 230 mV)
3. Press and hold the CAL key for at least 2 seconds to enter the calibration mode.
4. Press [-] to display the “OFFSET” message.
5. Release the button and the display will show the calibration solution value (mV).
6. If necessary, adjust the displayed value using the [+] or [-] key.
7. Press CAL to confirm the calibration, or press NEXT to exit without saving (previous calibration data are kept).



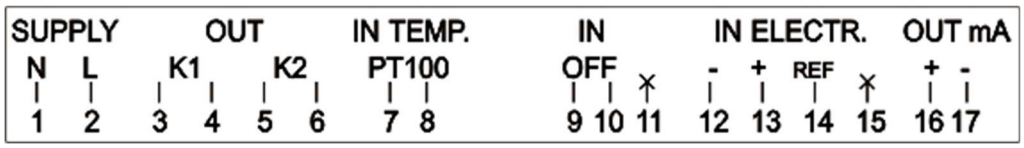
After performing the calibration, the meter does not display the standard solution value whenever:

a) The calibration solution is contaminated dirty or expired
b) The electrode is not working properly or it is exhausted
c) The electrode connection cable is damaged

Note: *If you attempt to calibrate the offset at a value too different from the internal one, the instrument shows the <<* ***Cal error!****>> message and does not save the calibration data.*

ORP calibration is a single point procedure (offset)!

SPECIFICATIONS OF TEMPERATURE INPUT



ELECTRICAL CONNECTIONS

The signal comes from a Pt100 sensor through a 2 or 3-wire cable, that has to be shielded if longer than 15 meters. Connections are made on removable terminal block, at pins 7 and 8.
If a sensor with 3-wire cable is used, connect to the same terminal the two wires of the same colour (internally short-circuited). If a shielded cable is used, connect the shield to terminal 14 (REF).

THERMOMETER CALIBRATION

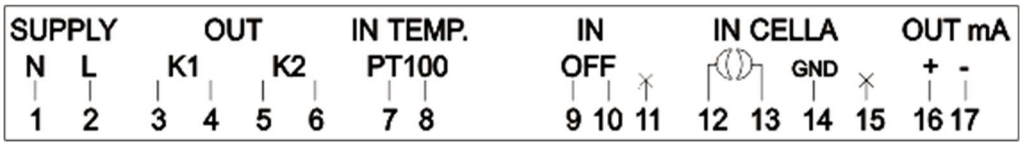
The electronic calibration of the instrument and the accuracy class of the Pt100 sensor ensure a maximum error of ±0.3°C at 0°C and ±0.8°C at 100°C (Pt100 class B, according to IEC 751 standard). Therefore, no user calibration is required.

***Note**: Factory calibration is performed with a sensor with 2 m cable. Using a probe with a cable longer than 2 meters could introduce a greater reading error.*

SPECIFICATIONS OF CONDUCTIVITY INPUT

ADDITIONAL TECHNICAL INFO

The electronic precision of the conductivity measurements is better than 1%, and the repeatability is better than 0.2% FS, without temperature compensation (resistive calibration). The temperature compensation introduces an additional error of 0.3% FS, and is performed through the PT100 input.
The temperature sensor may be a probe separated from the conductivity cell (e.g. PT100S), or a built-in sensor (e.g. CCK5TC). For further details, refer to the technical documentation supplied with the cell.



ELECTRICAL CONNECTIONS

The signal comes from the 2-electrode cell, to be connected to terminals 12 and 13; if a shielded cable is used, connect the shield to terminal 14 (GND). In case of low conductivity measurement, it is recommended to use a shielded cable.
The Pt100 sensor input is at terminals 7 and 8. If no temperature probe is connected, the instrument uses a constant working temperature of 25.0°C. If a Pt100 probe is used, immerse it in the liquid to be tested, close to the cell or anyway at the same temperature.
To avoid interferences and measure errors due to parasitic capacity of the cable, it is recommended to use a cell connection cable as short as possible. Do not extend the supplied cable; if a longer cable is needed, please contact the manufacturer.

Caution! Always keep signal cables away from power cable!

ELECTRICAL CALIBRATION

To test the proper functioning of the instrument, connect to the cell input a resistive simulator. Set an infinite resistor value and the meter should display “0”. To calculate the resistor value to be entered for simulating a given conductivity value, use the following formula:

$$Rcell = \frac{1}{(Cond \times K)} \quad \left(M\Omega = \frac{1}{(\mu S/cm \times cm)} \right)$$

Rcell = simulation resistor
Cond = conductivity value to be simulated
K = cell constant

Notes:

- *To verify the correct visualization, also consider the set “gain” factor. To view the gain value, press the [+] key.*
- *The temperature should be approx. 25°C; if not, leave terminals 24 and 25 not connected.*

ELECTROCHEMICAL CALIBRATION

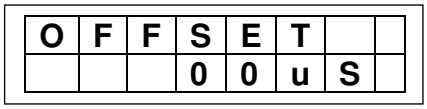
The electrochemical calibration allows to compensate errors due to the cell-instrument connection cable and to the mechanical error of the cell constant. If the temperature compensation feature is used, immerse the Pt100 sensor into the solution close to the cell, or anyway at the same temperature.

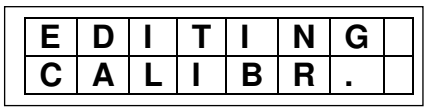
1. Leave the cell in air.
2. Press and hold CAL for at least 2 seconds to enter the calibration mode.
3. Press [-]: the OFFSET message is displayed, and then “0” value.
4. The zero value with cell in air is generally not adjusted, but - if necessary - use the [+] and [-] keys.

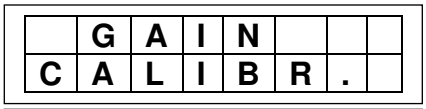
E	D	I	T	I	N	G	
C	A	L	I	B	R	.	

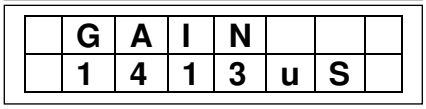
O	F	F	S	E	T		
C	A	L	I	B	R	.	

5. Press CAL to confirm calibration, or NEXT to exit without saving (previous calibration data are kept).
6. Immerse the cell into a standard conductivity solution (see the table below).
7. Press and hold CAL for at least 2 seconds to enter the calibration mode.
8. Press [+]:the “GAIN” message is displayed, and then the previous measurement or a known standard value automatically recognized.
9. If necessary, adjust this value using the [+] / [-] keys.
10. Press CAL to confirm calibration, or NEXT to exit without saving (previous calibration data are kept).







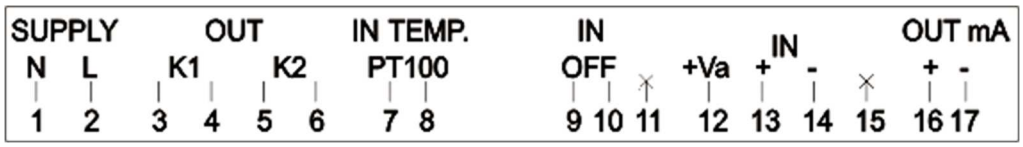


Note: *If you attempt to calibrate using an offset value too different from the range minimum value or a gain value with a too low input signal, the instrument shows the <<* ***Cal error!****>> message and does not save the calibration data.*

Conductivity values of KCl (potassium chloride) solutions:

Temp. (°C)	KCl 1 N (µS/cm)	KCl 0.1 N (µS/cm)	KCl 0.01 N (µS/cm)
0	65410	7150	776
5	74140	8220	896
10	83190	9330	1020
15	92540	10480	1147
16	94430	10720	1173
17	96330	10950	1199
18	98240	11190	1225
19	100160	11430	1251
20	102090	11670	1278
21	104020	11910	1305
22	105940	12150	1332
23	107890	12390	1359
24	109840	12640	1386
25	111800	12880	1413
26	113770	13130	1441
27	115740	13370	1468
28		13620	1496
29		13870	1524
30		14120	1552

SPECIFICATIONS OF STANDARDIZED INPUT



ELECTRICAL CONNECTIONS

The signal comes from the transmitter (or transducer) through a 2 or 3-pole cable, that has to be shielded if longer than 20 meters.
Connections are made on removable terminal block as follows:

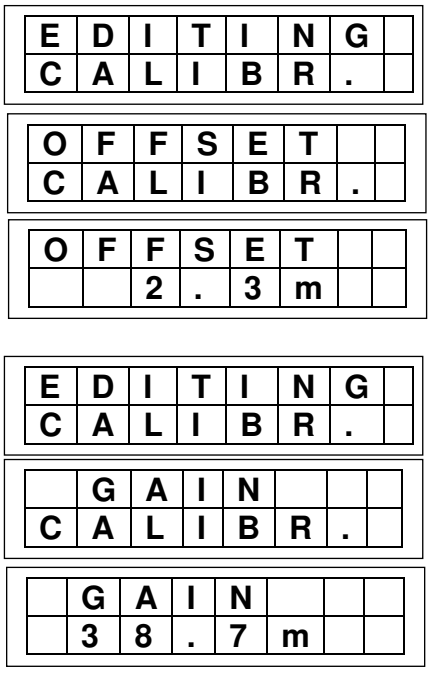
1. Passive transducer: terminal 14 = negative input (IN-)
   terminal 13 = positive input (IN+)
   terminal 12 = power supply positive (+Va)
2. Active transmitter: terminal 13 = positive input (IN+)
   terminal 14 = negative input (IN-)
3. 2-wire passive transmitter:
   terminal 12 (power supply) = positive input (+Va)
   terminal 14 = negative input (IN-)

If a shielded cable is used, connect the cable shield to terminal 14 (S504 side) and leave it disconnected on the transmitter side.

ELECTRICAL CALIBRATION

Errors due to instrument (S504) and transducer are typically very small and no calibration is required. However, in case of pressure transducer converted into piezometric levels, sometimes zero and gain calibrations are needed; proceed as explained here below.

1. Set the transmitter to have the minimum range signal (e.g. 0 or 4 mA).
2. Press and hold CAL for at least 2 seconds to enter the calibration mode.
3. Press [-]: the OFFSET message is displayed, and then the measurement value.
4. If necessary, adjust this value using the [+] / [-] keys.
5. Press CAL to confirm calibration, or NEXT to exit without saving (previous calibration data are kept)
6. Set the transmitter to have the full scale signal (or a signal greater than the 70% of the range).
7. Press and hold CAL for at least 2 seconds to enter the calibration mode.
8. Press [+]: the GAIN message is displayed, and then the previous measurement.
9. If necessary, adjust this value using the [+] / [-] keys.
10. Press CAL to confirm calibration, or NEXT to exit without saving (previous calibration data are kept).



Note: *If you attempt to calibrate using an offset value too different from the range minimum value or a gain value with a too low input signal, the instrument shows the <<* ***Cal error!****>> message and does not save the calibration data.*