MODBUS RTU

Integration Manual

pH Transmitter PH-RS485-32 and
Conductivity Transmitter LF-TR-MOD

Vendor-independent interface description for PLCs, SCADA systems, data loggers, PC software and custom embedded masters.

Purpose
This document contains all information required for connection, commissioning, data evaluation, parameterization and pH calibration via standard Modbus RTU. Knowledge of JUMO software is not required.

Document	Issue
Revision	1.7
Date	04.11.2026
pH firmware basis	v0.6.90
LF firmware basis	v1.12 / register ID 0x010C
Validity	For the firmware versions described in this manual

Subject to technical changes. Before release for series production, verify the connection ratings and firmware version on the nameplate or via the identification registers.

1 Quick Start

Both devices are Modbus RTU slaves on a two-wire RS-485 connection. Factory setting: slave address 10, 9600 bit/s, 8 data bits, no parity, 1 stop bit (8N1). Selectable baud rates: 9600, 19200, 38400, 57600 and 115200 bit/s.

1. Connect the supply and RS-485 according to Section 2; connect D1/B+ and D0/A- according to the pin table and route GND/Common with the bus.
2. **Set the master initially to 9600 bit/s, 8N1 and slave address 10. A baud-rate change starts an 8-second test window; reconnect at the new rate and confirm it with 0xB44D at 0x010B, otherwise the device automatically returns to the previous rate.**
3. pH: read product ID 0x7048 from register 0x7000. LF: read product ID 0x4C46 from register 0x0000.
4. Always evaluate the measured value and status together. A numerical value alone does not indicate validity.
5. Save configuration changes according to Section 6 or 8. After changing the slave address, use the new address starting with the next request.

Feature	PH-RS485-32	LF-TR-MOD
Measured variable	pH, electrode mV, temperature	Conductivity, cell resistance, temperature
Supply according to schematic	24 V DC	12/24 V DC
Factory setting	Address 10 · 9600 · 8N1	Address 10 · 9600 · 8N1
Float standard	Low word first	Low word first; selectable
Serial number	IMO-xxxxxx from hardware address	currently not available via Modbus
Calibration	guided pH calibration and one-point temperature calibration	cell constant K and one-point temperature calibration
Temperature sensors	NTC 2 kΩ, Pt1000 or no local sensor (external input)	NTC 2 kΩ or Pt1000

Address Notation
All register addresses in this document are true zero-based Modbus PDU addresses. Some PLC systems display the same addresses as 4xxxx numbers or add 1. Example: PDU address 0x0010 = decimal 16; depending on the software, this may appear as Holding Register 17 or 40017.

2 Electrical Connection

2.1 Recommended M12 Pin Assignment, A-coded, 4-pin

Pin	Wire color	Signal	Modbus designation	Note
1	Brown	+V	Supply	pH: 24 V DC; LF: 12/24 V DC
2	White	RS-485 D1 / B+	D1	positive data line
3	Blue	GND	Common	supply and bus reference
4	Black	RS-485 D0 / A-	D0	negative data line
Shield	Shield	FE / PE	Cable shield	connect with large-area contact according to system requirements

A/B Naming Conflict
The Modbus designation D1/D0 is authoritative. According to the Modbus Serial Line Specification, D1 = B/B' = + and D0 = A/A' = -. Therefore, for this product: pin 2 = D1/B+, pin 4 = D0/A-. Some RS-485 manufacturers use A/B differently; therefore always compare D1/D0 or + and -, and never interchange supply pins.

2.2 RS-485 Installation Rules

- Use a line topology; avoid long stubs.
- Install 120 Ω termination only at the two physical ends of the bus.
- Use a shielded, twisted D0/D1 pair; route the data cable separately from power cables.
- Each slave address may occur only once on the bus.
- Avoid potential differences outside the permissible RS-485 common-mode range; route GND/Common with the bus.
- Do not switch on the supply until the connector pin assignment and polarity have been checked.

No Universal M12 Modbus Pin Standard
Modbus RTU standardizes data transmission and RS-485 signals, but not a universal M12 pin assignment. The table above therefore defines the mandatory product pin assignment for these transmitters.

3 Common Modbus RTU Profile

Parameter	Value
Transmission	Modbus RTU over RS-485, 2-wire, half-duplex
Baud rate	9600, 19200, 38400, 57600 or 115200 bit/s; factory setting 9600 bit/s
Character format	8N1
Factory-set slave address	10 (0x0A)
Address range	1…247
Read functions	FC03 Read Holding Registers; FC04 reads the same register map
Write functions	FC06 Write Single Register; FC16 Write Multiple Registers
Broadcast address 0	Write commands are executed without a response; read requests are ignored
CRC	Modbus CRC-16, low byte first in the telegram

3.1 Data Formats

Type	Registers	Encoding
UInt16	1	16-bit unsigned; byte order within the register: high byte, low byte
Int16	1	16-bit two's complement; otherwise as UInt16
UInt32	2	Unless stated otherwise: high word first
Float32	2	IEEE-754 single precision. Product standard: low word first; high byte first within each register
ASCII	n	2 characters per register; first character in the high byte; padded with 0x00

Float Example 7.00
IEEE-754 = 0x40E00000. With low word first, register 0 = 0x0000 and register 1 = 0x40E0. On the wire: 00 00 40 E0. The byte order within a register is never reversed.

3.2 Exception Responses

Code	Meaning	Typical cause
0x01	Illegal Function	unsupported function code
0x02	Illegal Data Address	register does not exist, is write-protected, or state transition is invalid
0x03	Illegal Data Value	value outside the permissible range
0x06	Slave Device Busy	pH calibration step not yet permitted in the current state

3.3 Recommended Polling

- Read process values at 1 Hz; faster polling only increases bus load and does not necessarily provide new measurement information.
- Read the status and alarm registers in the same cycle.
- Read identification and configuration only when establishing a connection or after a change.

- Set the master's communication timeout to at least 250 ms; report the connection as faulty after three failed attempts.

4 PH-RS485-32 – Identification and Process Data

For third-party systems, the extended function block starting at 0x0000 is the most complete interface. The neutral service block starting at 0x7000 is suitable for compact commissioning and diagnostics. Both blocks are accessed using the same standard Modbus functions.

Identification and Interface

Address	R/W	Type / length	Meaning	Values / unit
0x0000…0x0004	R	ASCII[10]	Device name	„dl pH/ORP“
0x0100…0x0109	R	ASCII[20]	Serial number	IMO-xxxxxx; x = hexadecimal hardware address
0x010A	R	UInt16	Sensor type	1 = pH/ORP/temperature
0x010B	R	UInt16	Sensor subtype	0 = pH; 3 = pH + local temperature
0x0111…0x0116	R	ASCII[12]	Part number	PH-RS485-32
0x014F…0x0150	R	UInt32	Hardware address	24 valid bits; high word first
0x0151…0x015A	R	ASCII[20]	Manufacturer ID	IMO
0x0300	R/W	UInt16	Modbus address	1…247; change is saved
0x0301	R/W	UInt16	Baud-rate code	0 = 9600; only 0 is permitted
0x0302	R/W	UInt16	Format code	0 = 8N1; only 0 is permitted
0x0304	R/W	UInt16	Sensor version	compatibility/ information value
0x0305	R/W	UInt16	Minimum response time	compatibility/ information value
0x0307	R/W	UInt16	Float format	0 = IEEE-754, low word first; only 0 is permitted

Process Values and Alarms

Address	R/W	Type / length	Meaning	Values / unit
0x2600…0x2601	R	Float32	compensated pH value	pH
0x2602…0x2603	R	Float32	uncompensated electrode voltage	mV
0x2604…0x2605	R/W	Float32	temperature via interface	°C; −20…150 for calibration
0x2606	R	UInt16	pH alarm	0 = off; 1 = electrode/signal invalid
0x2620…0x2621	R	Float32	local temperature	°C
0x2622…0x2623	R	Float32	local temperature	°F
0x2624…0x2625	R	Float32	temperature sensor resistance	Ω; 0 if no local sensor is available

Address	R/W	Type / length	Meaning	Values / unit
0x2626	R	UInt16	temperature alarm	0 = off; 1 = temperature error
0x2640	R	UInt16	Binary input	currently 0 / reserved
0x26A0	R	UInt16	general sensor error	0 = OK; 1 = temperature, type or electrode error
0x26A3	R	UInt16	Calibration alarm	0 = off; 1 = interval expired or calibration failed

Temperature Source
If a plausible NTC 2 kΩ or Pt1000 sensor is present, its temperature is used. With 0x7101 = 2 the local temperature input remains unexcited. pH compensation then starts at 25.0 °C; an external temperature supplied by JUMO or the PLC has priority. Temperature calibration is unavailable in this mode.

5 PH-RS485-32 – Service Block and Status

Service and Configuration Registers

Address	R/W	Type / length	Meaning	Values / unit
0x7000	R	UInt16	Product ID	0x7048
0x7001	R	UInt16	Firmware major version	0x0006 for v0.6.x
0x7010…0x7011	R	Float32	pH value	word order according to 0x7102
0x7012…0x7013	R	Float32	Temperature	°C; word order according to 0x7102
0x7014	R	Bit field	Device status	see bit table
0x7015	R	Int16	Electrode voltage	mV × 10
0x7100	R/W	UInt16	Modbus address	1…247; effective immediately; save with 0x710F
0x7101	R/W	UInt16	Temperature sensor type	0 = NTC 2 kΩ; 1 = Pt1000; 2 = no local sensor / external input
0x7102	R/W	UInt16	Float word order, service block	0 = Low/High (default); 1 = High/Low
0x7103	R/W	UInt16	Temperature measurement interval	2…600 s; default 10 s
0x710F	R/W	Command	Save configuration	write 1; read returns 0
0x7016…0x7017	R	Float32	Temperature sensor resistance	Ω
0x7018…0x7019	R	Float32	Uncorrected temperature	°C
0x7110…0x7111	R/W	Float32	Temperature calibration reference	0.00…100.00 °C
0x7112…0x7113	R	Float32	Active temperature offset	±5.00 °C
0x7114…0x7115	R	Float32	Stored calibration point	°C

Address	R/W	Type / length	Meaning	Values / unit
0x7116	R	UInt16	Temperature calibration status	0 ready; 1 applied; 2 reset; 3…5 error
0x7117	W	Command	Temperature calibration command	1 apply; 2 reset
0x7104	R/W	UInt16	Electrode check	0 = off; 1 = on; store via 0x710F
0x7105	R/W	UInt16	Electrode-check interval	10…600 s; default 10 s; store via 0x710F
0x7106	R/W	UInt16	Modbus baud rate / 100	96, 192, 384, 576 or 1152; store via 0x710F

Bit	Mask	Meaning	Master response
0	0x0001	Temperature error	do not use temperature; check 0x2626
1	0x0002	Calibration active	flag the measured-value display; do not start a second calibration
2	0x0004	Factory/default calibration active	recommend calibration
3	0x0008	Sensor type/plausibility error	check wiring and 0x7101
4	0x0010	Non-volatile memory error	save configuration again; service if persistent
5	0x0020	Electrode error	discard pH value; check electrode/cable
6	0x0040	Temperature sensor calibrated	Apply stored offset

5.1 Electrode Monitoring

The internal monitoring function checks the electrode and cable at an adjustable interval and detects short circuits/glass breakage and open circuits. The factory setting is 10 s; 0x7105 accepts every whole-second value from 10 to 600 s.

- Test phase: no longer than approximately 0.5 s; it ends immediately when the electrode is identified as good.
- Recovery phase: 2 s. During test and recovery, the last valid pH value remains available.
- One failed test immediately sets the pH alarm and the general sensor fault.
- One subsequent good test clears both alarms again.
- No check is performed during calibration. For high-temperature applications it can be disabled with 0x7104 = 0 and enabled with 0x7104 = 1; store via 0x710F = 1.

6 PH-RS485-32 – Calibration and Reminder Timer

Calibration Registers

Address	R/W	Type / length	Meaning	Values / unit
0x2280	R/W	UInt16	Calibration interval	0 = off; 1…9999 days
0x2420…0x2421	R	UInt32	Remaining time	seconds; high word first
0x2660	R/W	UInt16	Method	0 = zero point; 1 = two-point
0x2661	R/W	UInt16	Temperature Source	0 = local; 1 = interface
0x2662	R/W	UInt16	Calibration step	sequence described below

Address	R/W	Type / length	Meaning	Values / unit
0x2663…0x2666	R/W	2 × Float32	Reference values P1/P2	pH; low word first
0x2667…0x266A	R/W	2 × Float32	Test temperatures P1/P2	°C; low word first
0x266B…0x266C	R	Float32	calculated pH zero point	pH
0x266D…0x266E	R	Float32	calculated slope	%
0x266F	R	UInt16	Zero-point evaluation	0 none; 1 OK; 2 warning; 3 limit violated; 4 failed
0x2670	R	UInt16	Slope evaluation	as 0x266F
0x2671	R	UInt16	next log index	currently 0

6.1 Two-Point Calibration

1. Write 0x2660 = 1 and set 0x2661 to match the temperature source.
2. Write 0x2662 = 1. Place the electrode in buffer 1 and wait until 0x2600 is stable.
3. Write 0x2662 = 2; this accepts measurement point 1.
4. Rinse the electrode, place it in buffer 2 and wait for a stable measured value.
5. Write 0x2662 = 3; this accepts measurement point 2.
6. Write the reference values to 0x2663…0x2666. For external temperature, also populate 0x2667…0x266A.
7. Write 0x2662 = 4. Read the result from 0x266B…0x2670 and continue only if the evaluation is permissible.
8. Write 0x2662 = 5. The valid calibration is accepted and stored in non-volatile memory.

6.2 Zero-Point Calibration

1. **Write 0x2660 = 0 and select the temperature source in 0x2661.**
2. **Write 0x2662 = 1. Place the electrode in a neutral buffer from pH 6.0 to 8.0 and wait until 0x2600 is stable.**
3. **Write the exact buffer value as Float32 to 0x2663…0x2664, then write 0x2662 = 2 to accept the current filtered reading.**
4. **Write 0x2662 = 3. Read the calculated zero point and evaluations from 0x266B…0x2670. Only the offset is recalculated; the existing slope remains unchanged.**
5. **Write 0x2662 = 4 to accept a valid result. The calibration is stored in non-volatile memory and the calibration timer restarts. Write 0x2662 = 0 at any time to cancel without changing the previous calibration.**

State Machine

A premature or inappropriate calibration step is answered with exception 0x06 (Busy) or 0x02. Do not repeat the step blindly: first read 0x2662, allow the process value to stabilize and establish the expected next state.

6.3 Calibration Timer Behavior

- The timer counts only while the device is powered. Time without power does not count as operating time.
- The remaining time is written to non-volatile memory every hour. After a hard power-off, at most the current partial hour may appear to have been reset.
- After a successful calibration, the configured interval starts again.
- When the remaining time reaches 0, register 0x26A3 sets the calibration alarm.
- An interval of 0 disables the reminder function.

7 LF-TR-MOD – Process Data

Process and Diagnostic Registers

Address	R/W	Type / length	Meaning	Values / unit
0x0000	R	UInt16	Product ID	0x4C46 (LF)
0x0001	R	UInt16	Firmware version	0x010C = v1.12
0x0010…0x0011	R	Float32	Compensated conductivity	Selected unit; rounded to 3 significant digits
0x0012…0x0013	R	Float32	Raw conductivity	S/cm, uncompensated
0x0014…0x0015	R	Float32	Temperature	°C
0x0016	R	Bit field	Status	See bit table
0x0017	R	UInt16	Active measuring range	1…5
0x0018	R	UInt16	Display mantissa	0…999
0x0019	R	Int16	Decimal exponent	Value = mantissa × 10^exponent
0x001A	R	UInt16	Actual unit	1 = µS/cm; 2 = mS/cm
0x001B…0x001C	R	Float32	Cell resistance	Ω; 0 for open/short, status decides
0x001D	R	UInt16	Raw ADC K1	0…4095; diagnostics
0x001E	R	UInt16	Raw ADC K2	0…4095; diagnostics
0x001F	R	UInt16	Raw ADC NTC	0…4095; diagnostics
0x0020…0x0021	R	Float32	Temperature-sensor resistance	Ω
0x0022…0x0023	R	Float32	Uncorrected temperature	°C
0x0024	R	UInt16	Temperature value valid	0 no; 1 yes
0x0025…0x0026	R	Float32	Enclosure humidity	% RH; optional SHT30A
0x0027…0x0028	R	Float32	SHT30A temperature	°C; enclosure temperature
0x0029	R	UInt16	Humidity value valid	0 no; 1 yes
0x002A	R	UInt16	SHT30A raw humidity	Diagnostics
0x002B	R	UInt16	SHT30A raw temperature	Diagnostics
0x002C	R	UInt16	Humidity sensor detected	0 not fitted/not detected; 1 present

Bit	Mask	Meaning	Validity
0	0x0001	Measuring cell open	Discard conductivity and resistance
1	0x0002	Measuring cell short-circuited	Discard conductivity and resistance
2	0x0004	Measurement invalid	Discard process value
3	0x0008	Temperature error	Do not use compensation/temperature

Bit	Mask	Meaning	Validity
4	0x0010	Non-volatile memory error	Check and save configuration again
5	0x0020	Temperature sensor calibrated	Stored offset active
6	0x0040	SHT30A communication/CRC error	Only after a sensor was detected
7	0x0080	Enclosure humidity alarm	Set at 30.0 % RH; cleared at 28.0 % RH

If the measuring cell is open or short-circuited, 0x001B…0x001C returns 0; status bits 0x0001/0x0002 distinguish the condition. For stainless-steel cells with K below 0.8000, 0.443 ohm is subtracted from the calculated cell resistance in all five ranges. At K 0.8000 and above the correction is disabled for graphite cells. An SHT30A that was never detected is treated as not fitted and does not create an error.

8 LF-TR-MOD – Configuration

Configuration Registers

Address	R/W	Type / length	Meaning	Values / unit
0x0100	R/W	UInt16	Modbus address	1…247; effective immediately
0x0101	R/W	UInt16	Cell constant K	K × 10000; 25…50000 = 0.0025…5.0000
0x0102	R/W	UInt16	Temperature compensation	0 off; 1 natural; 2 linear
0x0103	R/W	UInt16	Linear TC	%/K × 100; 0…600 = 0…6.00 %/K
0x0104	R/W	Int16	Reference temperature	°C × 10; −500…1500 = −50.0…150.0 °C
0x0105	R/W	UInt16	Unit mode	0 automatic; 1 µS/cm; 2 mS/cm
0x0106	R/W	UInt16	Float word order	0 High/Low; 1 Low/High (default)
0x0107	R/W	UInt16	Temperature sensor type	0 NTC 2 kΩ; 1 Pt1000
0x0108	R/W	UInt16	Temperature interval	2…600 s; default 10 s
0x0109	R/W	UInt16	Modbus baud rate / 100	96, 192, 384, 576 or 1152
0x010A	R	UInt16	Baud-rate test status	0 stable; 1 confirmation pending
0x010B	W	Command	Confirm new baud rate	Write 0xB44D within 8 seconds
0x010F	R/W	Command	Save configuration	Write 0xA55A; read returns 0
0x0110…0x0111	R/W	Float32	Temperature calibration reference	0.00…100.00 °C
0x0112…0x0113	R	Float32	Active temperature offset	±5.00 °C
0x0114…0x0115	R	Float32	Stored calibration point	°C

Address	R/W	Type / length	Meaning	Values / unit
0x0116	R	UInt16	Temperature calibration status	0 ready; 1 accepted; 2 cleared; 3…5 error
0x0117	W	Command	Temperature calibration command	1 accept; 2 reset

8.1 Factory Settings

Parameter	Factory setting
Slave address	10
Baud rate	9600 bit/s
Cell constant	K = 1.0000
Temperature compensation	Natural
Linear temperature coefficient	2.00 %/K (preset if linear is selected)
Reference temperature	25.0 °C
Unit	Automatic
Float word order	Low word first
Temperature sensor	NTC 2 kΩ
Temperature interval	10 s

8.2 Saving, address and baud-rate changes

1. **Write the required parameters and verify every FC06/FC16 response.**
2. **A change to 0x0100 takes effect immediately after the response; continue at the new address.**
3. **For a baud-rate change at 0x0109, reconnect at the new rate within 8 seconds and write 0xB44D to 0x010B. Without confirmation the previous rate is restored automatically.**
4. **Write 0xA55A to 0x010F to save the confirmed configuration, read it back and perform a power-cycle test.**

Conductivity Calibration
Guided multipoint calibration is not provided in the current LF Modbus profile. Traceability is established using a conductivity standard; the resulting cell factor is entered as cell constant K in 0x0101 and then saved.

8.3 One-Point Temperature Calibration

The procedure is identical for both products. Select NTC 2 kΩ or Pt1000, bring the sensor and a precision thermometer to the same stable temperature, write the thermometer value to the reference register, and write command 1. The device stores offset = reference minus raw temperature for the selected sensor type. The corrected temperature is then used for the process value and compensation. Reference values outside 0 to 100 °C and offsets above ±5 °C are rejected. Command 2 resets only the calibration of the currently selected sensor type. Flash memory is written only by apply or reset, not by cyclic temperature measurements.

9 Telegram Examples

All examples use slave address 10 (0x0A). The last two bytes are CRC Low/High. Spaces are used only for readability.

9.1 Reading the pH Value from the Service Block

Direction	Telegram	Explanation
Master → Slave	0A 03 70 10 00 02 DE 75	FC03, start 0x7010, 2 registers
Slave → Master	0A 03 04 00 00 40 E0 70 BB	Example 7.00 pH; low word 0000, high word 40E0

9.2 Reading LF Conductivity

Direction	Telegram	Explanation
Master → Slave	0A 03 00 10 00 02 C4 B5	FC03, start 0x0010, 2 registers
Slave → Master	variable	4 data bytes as Float32 in the word order defined by 0x0106

9.3 Changing the LF Address from 10 to 11 and Saving It

Step	Telegram	Note
Write address	0A 06 01 00 00 0B C8 8A	response is an echo; then use address 11
Save	0B 06 01 0F A5 5A …CRC	send to new address 0x0B

9.4 Setting the pH Calibration Interval to 20 Days

Direction	Telegram	Explanation
Master → Slave	0A 06 22 80 00 14 83 2E	0x2280 = 20 days
Slave → Master	identical echo	write successful
Verification	0A 03 24 20 00 02 CE 4A	read remaining time as UInt32 seconds

9.5 Reference Pseudocode for Float32

```
# regs[0], regs[1] are 16-bit Modbus registers
# Default: low word first
u32 = (regs[1] << 16) | regs[0]
value = ieee754_single_from_u32(u32)

# For high word first
u32 = (regs[0] << 16) | regs[1]
```

10 Integration and Acceptance Test

No.	Test	Expected result
1	Measure supply/polarity	voltage matches device; no heating or overcurrent
2	Read product ID	pH 0x7048 or LF 0x4C46
3	Read measured value + status	status 0; plausible value and correct unit
4	Float test with known value	no word/byte reversal
5	Change address, save, restart	only the new address responds; value remains saved
6	Disconnect sensor/cable	appropriate status/alarm bit is set
7	Reconnect sensor	error clears according to device behavior
8	pH calibration	result valid; retained after restart

No.	Test	Expected result
9	pH calibration timer	remaining time runs only while powered and is largely retained after restart
10	24-hour bus operation	no CRC, timeout or address errors
11	Temperature one-point calibration	corrected value and sensor-specific storage remain after restart

11 Troubleshooting

Symptom	Check	Action
no response	address, configured baud rate/8N1, D0/D1, GND, supply	start with the product ID; verify D0/D1 or +/- against the pin table
CRC error	shielding, termination, stubs, timing	correct the bus cable and termination; reduce polling frequency
value completely wrong	float word order	use Low/High or check 0x0106/0x7102
value wrong by a factor of 10/100	scaling of integer registers	apply x10, x100 and x10000 as specified in the table
pH value is briefly held	electrode test active	wait until the internal test/recovery phase is complete; evaluate status
calibration step Busy	0x2662 and stable process value	follow the correct sequence; allow the buffer to stabilize
LF resistance = 0	status 0x0016	distinguish open and short circuit using bit 0/1
setting lost after restart	save command	pH 0x710F = 1; LF 0x010F = 0xA55A
temperature calibration rejected	0x7116 or 0x0116, raw value, sensor type	use 0…100 °C reference; check wiring if deviation exceeds ±5 °C

12 Register Quick Reference

Device	Function	Address(es)	Note
pH	Identification	0x0000, 0x0100, 0x0111, 0x014F	name, serial number, part number, hardware address
pH	Process	0x2600…0x2640	pH, mV, temperature, alarms
pH	Error/alarm	0x2606, 0x2626, 0x26A0, 0x26A3	separate alarm causes
pH	Calibration	0x2660…0x2671	state machine
pH	Calibration timer	0x2280, 0x2420…0x2421	days and remaining seconds
pH	Service	0x7000…0x7117	compact commissioning/diagnostics
LF	Process	0x0000…0x002C	Measurements, status, humidity, raw values
LF	Configuration	0x0100…0x0117	address, K, TC, unit, float
LF	Save	0x010F	write 0xA55A
pH/LF	Temperature calibration	0x7110–17 / 0x0110–17	reference, offset, point, status, command

13 Implementation Limits and Version Information

- This manual describes the interface, not the metrological product specification. Measuring range, accuracy, permissible ambient conditions and approvals must be specified in an approved product data sheet.
- The LF-TR-MOD currently does not publish a serial number or hardware address via Modbus. Systems must therefore identify the device by its bus address and installation location.
- No guided calibration history or calibration-alarm function is implemented for the LF-TR-MOD. Firmware 1.12 continuously adapts excitation to conductivity in measuring ranges 1 to 3; ranges 4 and 5 retain fixed pulse lengths. The optional SHT30A monitors enclosure humidity and does not cause an error when it is not fitted.
- Registers not listed in this document are reserved. A master must neither assume their existence nor write to them.
- For future firmware versions, first verify the product ID, firmware version and this document revision.

14 References

Modbus Organization: MODBUS over Serial Line Specification and Implementation Guide V1.02, https://modbus.org/docs/Modbus_over_serial_line_V1_02.pdf

Firmware sources: PH-RS485-32 v0.6.90 and LF-TR-MOD v1.12, register definitions and successful target builds, as of 4 November 2026. PC monitor reference: PC 1.16.

Document Changes

Revision	Date	Change
1.1	05.10.2026	Common Modbus interface for pH and conductivity; corrected line designations: D1 = B+ and D0 = A-
1.2	05.10.2026	Pt1000 support, duty-cycled temperature input and sensor-specific one-point temperature calibration
1.3	07.10.2026	Supported neutral-buffer zero-point calibration documented; existing slope retained, result stored and calibration timer restarted; electrode-check interval adjustable from 10 to 600 seconds
1.4	10.10.2026	No-local-temperature-sensor selection documented; added the 25.0 °C fallback and priority of external JUMO/PLC temperature
1.5	20.10.2026	Selectable baud rates from 9600 to 115200 bit/s; added registers 0x7106 (pH) and 0x0109 (LF); updated firmware basis
1.6	03.11.2026	Updated LF firmware basis to v1.9; corrected calibrated-temperature status bit to 0x0020; documented conductivity-dependent excitation and the 0.443 ohm stainless-steel series correction.
1.7	04.11.2026	LF firmware basis updated to v1.12; optional SHT30A registers, humidity alarm and absence handling documented; safe 8-second baud-rate confirmation and rollback added; PC monitor reference updated to 1.16.