

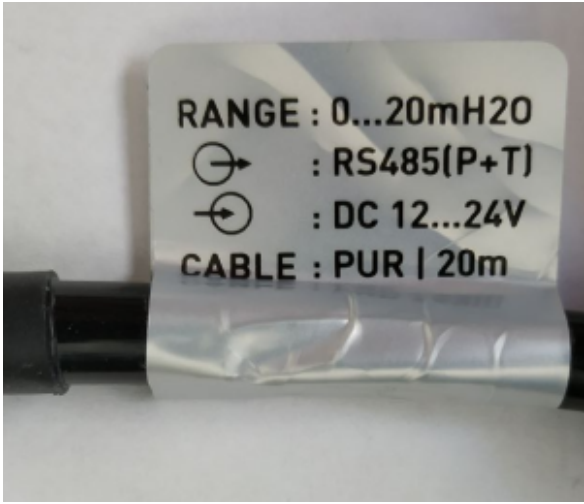
Pressure Sensor Application

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Lobaro Pressure or Lobaro Pressure and Temperature Sensor

Lobaro Platform Device Type: LOBARO-PEGELSONDE-HYBRID

Select the correct sensor by checking the cable flag. The Pressure and Temperature sensor got a "P+T" marking.

Lobaro Pressure and Temperature Sensor	Lobaro Pressure Sensor	KELLER S 26X
Lobaro article: #3000625	Lobaro article: #3000598 (discontinued)	Lobaro article: 0701
		

• 0 - 15 mH2O (other lengths on request) • Accuracy: +/- 0.25% FSO (Fully Scale Output) • Drift: +/- 0.3% FSO per year • For water level sensing applications	• 0 - 15 mH2O • Accuracy: 0.5% +/- FSO (Fully Scale Output) • Drift: +/- 0.3% FSO per year • For water level sensing applications	• Typ: "P / 16mH 00001-(• 0 - 16 n • Accurac 0.25% I (Fully S Output) • White=I • Black = • Blue=R • Yellow= • Water l sensing applica tank lev sensing • More In eller Wi
Red = VCC, Green = GND, RS485A = Yellow, RS485B = Blue		
CABLE CONNECTIONS & COLORS 		

Lobaro Pressure and Temperature Sensor

To read out the pressure & temperature probe, the Hybrid Modbus Gateway must be configured as follows:

Parameter	Value	Comment
WAN	lorawan	For LoRaWAN OTAA usage.
PLFmt	5	Sets the payload to a short format.
MbCmd	0 0/15 * * * *:R,9600,8N1:010300160002,010300260002,fa0400050001	• 010300160002 - Read register 22-23 (pressure) • 010300260002 - Read register 38-39 (temperature) • FA0400050001 - Read internal register 5 (vBat) The CRON Expressions can be adjusted to set time of sensor reading.
PowerOnDelay	3000	<i>Battery variant only.</i> Sets time (in ms) between activating sensor power and reading value (time for sensor to be ready).

Command (since FW v0.10.2)

Starting from v0.10.2 we support a command for LoRaWAN only!

Parameter	Value	Comment
Cmd	0 * * * * *:pressure(port=20)	Special command to upload in same format but calculating a more stable pressure value

Modbus Register Mapping

The probe is a Modbus slave with the following registers:

Modbus Command: <Slave Address (1)><Function (1)><Address (2)><Length (2)>

- Length = Register count -> 1 Register = 2 Bytes
- Function
 - 0x03 = Read Holding Register
 - 0x04 = Read Input Register
 - 0x06 = Write Holding Register

Address	Function	Bytes	Data Scope	Description
0x0000	0x03, 0x06	2	1-255	Slave Address
0x0001	0x03, 0x06	2	• 0-1200 • 1-2400 • 2-4800 • 3-9600 • 4-19200 • 5-38400 • 6-57600 • 7-115200	Baud rate
0x0002	0x03, 0x06	2	• 0 -No • 1- Odd • 2 - Even	• No check • Odd check • Even check
0x0003	0x03	2	• 0- kpa • 1- Mpa • 2- ma • 3- % • 4- InH2o • 5- FtH2o • 6- mmH2o • 7- mmHg • 8- psi • 9- bar • 10- mBar • 11- g/cm² • 12- kg/cm² • 13- Pa • 14- Torr • 15- Atm • 16- Null • 17- M • 18- cm • 19- mm • 20-InHg • 21- mHg • 22- MH2O • 23- °C	Pressure unit
0x0004	0x03	2	• 0 -#### • 1- ###.# • 2 - ##.## • 3 - #.### • 4 - #.####	Decimal point stands for 0-4 digits decimal points
0x0005	0x03	2	0-30	Filtering Coefficient
0x0016-0017	0x03	4	4 byte float	Measurement Pressure output value
0x0018-0019	0x03, 0x06	4	4 byte float	Master variable of Pressure offset
0x001A-001B	0x03	4	4 byte float	Range minimum of Pressure Transmitter
0x001C-001D	0x03	4	4 byte float	Range maximum of Pressure Transmitter
0x001E-001F	0x03	4	4 byte float	Range minimum of Pressure Sensor
0x0020-0021	0x03	4	4 byte float	Range maximum of Pressure Sensor
0x0026-0027	0x03	4	4 byte float	Measurement Temperature output value
0x00A6-00A7	0x06	4	4 byte float	Zero Clearing value of Pressure Transmitter

0xFFFF	0x06	2	0 - save to user area	Save data to user area
0xFFFC	0x06	2	0 - factory reset	Restore to factory status (user settings and calibration data)

Data Uplink (Port 20)

Bytes	0 .	1 . 2 . 3 . 4 .	5 . 6 . 7 . 8 .	9 . 10 .	
Field	Header	Pressure	Temperature	Voltage	

All values are encoded **big-endian**

Field	Type	Value
Header	uint8	0x00 on success, 0x80 if an error occurred
Pressure	float32	Pressure in mH2O, ffffffff on error.
Temperature	float32	Temperature in °C, ffffffff on error.
Voltage	uint16	Voltage in mV, ffff on error

010300160002

Example

```
# Example of a successful measurement
'003d94ce4541b7a5120e2a'
'00'      -> Successful readout
'3d94ce45' -> 0.073 mH2O
'41b7a512' -> 22.96 °C
'0e2a'    -> 3626 mV / 3.626 V

# Example
'80ffffffffffffffff'
'80'      -> An error occurred.
'ffffffff' -> Pressure could not be read.
'ffffffff' -> Temperature could not be read.
'ffff'    -> Voltage could not be read.
```

Reference Parser

see below

Lobaro Pressure Sensor

Reading from the Lobaro Pressure Sensor using the Hybrid Gateway can be done by setting the following parameters in the configuration:

Parameter	Value	Comment
WAN	lorawan	For LoRaWAN OTAA usage.
PlFmt	5	Sets the payload to a short format.
MbCmd	0 0/15 * * * *:R,9600,8N1:010300040001,fa0400040001,fa0400050001	010300040001 - Read register 4 (pressure) - fa0400040001 - Read internal register 4 (temperature in box) - fa0400050001 - Read internal register 5 (vBat) The CRON Expressions can be adjusted to set time of sensor reading.

PowerOnDelay	3000	Battery variant only. Sets time (in ms) between activating sensor power and reading value (time for sensor to be ready).
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Modbus Register Mapping

The probe is a Modbus slave with the following registers:

Modbus Command: <Slave Address (1)><Function (1)><Address (2)><Length (2)>

- Length = Register count -> 1 Register = 2 Bytes
- Function
 - 0x03 = Read Holding Register
 - 0x06 = Write Holding Register

Address	Function	Bytes	Data Scope	Description
0x0000	0x03, 0x06	2	1-255	Slave Address
0x0001	0x03, 0x06	2	• 0-1200 • 1-2400 • 2-4800 • 3-9600 • 4-19200 • 5-38400 • 6-57600 • 7-115200	Baud rate
0x0003	0x03	2	• 0 -#### • 1- ####.# • 2 - ##.### • 3 -#.####	Decimal point stands for 0-3 digits decimal points
0x0002	0x03	2	• 0- Mpa/ • 1- Kpa • 2- Pa • 3- Bar • 4- Mbar • 5- kg/cm2 • 6- psi • 7- mh2o • 8- mmh2o	Pressure unit
0x0004	0x03	2	-32768-32767	Measurement output value
0x0005	0x03	2	-32768-32767	Zero point of transmitter range
0x0006	0x03	2	-32768-32767	Full point of transmitter range
0x000c	0x03, 0x06	2	-32768-32767	Zero point offset value, generally factory sets as 0
0x000F	0x06	2	• 0 - save to user area	
0x0010	0x06	2	• 1 - factory reset	

Data Uplink LoRaWAN (Port 20)

Bytes	0 .	1 . 2 .	3 . 4 .	5 . 6 .	
	-----+	-----+	-----+	-----+	-----+
Field	Header	Pressure	Temperature	Voltage	

All values are encoded **big-endian**

Field	Type	Value
Header	uint8	0x00 on success, 0x80 if an error occurred

Pressure	int16BE	Pressure in mmH2O
Temperature	int16BE	Temperature in °C inside Bridge
Voltage	uint16BE	Voltage in mV, ffff on error

Example

```
# Example of a successful measurement
'000211001a0e2a'
'00'      -> Successful readout
'0211'    -> 529   -> 0.529 mH2O
'001a'    -> 26    -> 26°C (inside Box)
'0e2a'    -> 3626  -> 3626 mV / 3.626 V
```

Keller PR26X

Configuration

Connected pressure sensor probe from Keller Druckmesstechnik [PR26X series](#).

Parameter	Value	Comment
WAN	lorawan	For LoRaWAN OTAA usage.
PlFmt	5	Sets the payload to a short format.
MbCmd	0 0 ***:R,9600,8N1: 010300020002,010300080002,FA0400050001	Reads four Registers: 2 + 3 (Float, Pressure in Bar) and 8 + 9 (Float, Probe Temperature) + Device battery voltage
PowerOnDelay	1500	<i>Battery variant only.</i> Sets time (in ms) between activating sensor power and reading value (time for sensor to be ready).

Example Modbus response

Hex to float converter: <https://gregstoll.com/~gregstoll/floattohex/>

Pressure (0x3f75f07b):

P1	1	request	0x01 0x03 0x00 0x02 0x00 0x02 0x65 0xCB	0.960701 bar
		response	0x01 0x03 0x04 0x3F 0x75 0xF0 0x7B 0xE3 0xDE	

Temperature (0x41b5c079):

TOB1	1	request	0x01 0x03 0x00 0x08 0x00 0x02 0x45 0xC9	22.719°C
		response	0x01 0x03 0x04 0x41 0xB5 0xC0 0x79 0x6E 0x0B	

Data Uplink (Port 20)

Bytes	0 .	1 . 2 . 3 . 4 .	5 . 6 . 7 . 8 .	9 . 10 .	
Field	Header	Pressure	Temperature	Voltage	

All values are encoded **big-endian**

Field	Type	Value
Header	uint8	0x00 on success, 0x80 if an error occurred
Pressure	float32	Pressure in Bar, ffffffff on error.
Temperature	float32	Temperature in °C, ffffffff on error.

Voltage	uint16	Voltage in mV, ffff on error
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Keller PR46X

Configuration

Connected pressure sensor probe from Keller Druckmesstechnik [PR46X series](#).

Parameter	Value	Comment
WAN	lorawan	For LoRaWAN OTAA usage.
PLFmt	5	Sets the payload to a short format.
MbCmd	0 0 ***:R,9600,8N1: 010300020002,010300060002,FA0400050001	Reads four Registers: 2 + 3 (Float, Pressure in Bar) and 6 + 7 (Float, Probe Temperature) + Device battery voltage
PowerOnDelay	1500	<i>Battery variant only.</i> Sets time (in ms) between activating sensor power and reading value (time for sensor to be ready).

Data Uplink (Port 20)

Bytes	0 .	1 . 2 . 3 . 4 .	5 . 6 . 7 . 8 .	9 . 10 .	
	-----+	-----+	-----+	-----+	-----+
Field	Header	Pressure	Temperature	Voltage	

All values are encoded **big-endian**

Field	Type	Value
Header	uint8	0x00 on success, 0x80 if an error occurred
Pressure	float32	Pressure in Bar, ffffffff on error.
Temperature	float32	Temperature in °C, ffffffff on error.
Voltage	uint16	Voltage in mV, ffff on error

LoRaWAN JavaScript Reference Parser (All probe variants)

LORAWAN ONLY WORKS WITH DEFAULT CONFIG FOR MBCMD!

Pressure Probe Parser

```
/**
 * Parser for Lobaro Pressure Probe via LoRaWAN (hybrid gateway).
 * Usable for Pressure Probe as or with Presure+Temperature Probe.
 * Works with TTN, ChirpStack, or the Lobaro Platform.
 */
function signed(val, bits) {
  // max positive value possible for signed int with bits:
  var mx = Math.pow(2, bits-1);
  if (val < mx) {
    // is positive value, just return
    return val;
  } else {
    // is negative value, convert to neg:
    return val - (2 * mx);
  }
}

// Note that MAX_SAFE_INTEGER is 9007199254740991
function toNumber_BE(bytes, len, signed) {
```

```

var res = 0;
var isNeg = false;
if (len == 0) {
    len = bytes.length;
}
if (signed) {
    isNeg = (bytes[0] & 0x80) != 0;
}

for (var i = 0; i < len ; i++) {
    if (i == 0 && isNeg) {
        // Treat most-significant bit as -2^i instead of 2^i
        res += bytes[i] & 0x7F;
        res -= 0x80;
    } else {
        res *= 256;
        res += bytes[i];
    }
}

return res;
}
function int16_BE(bytes, idx) {
    bytes = bytes.slice(idx || 0);
    return signed(bytes[0] << 8 | bytes[1] << 0, 2*8);
}
function int32_BE(bytes, idx) {
    bytes = bytes.slice(idx || 0);
    return toNumber_BE(bytes, 4, true);
}
function uint16_BE(bytes, idx) {
    bytes = bytes.slice(idx || 0);
    return bytes[0] << 8 | bytes[1] << 0;
}
function uint32_BE(bytes, idx) {
    bytes = bytes.slice(idx || 0);
    return bytes[0] << 24 | bytes[1] << 16 | bytes[2] << 8 | bytes[3] << 0;
}
// float32([62, 132, 168, 155]) = 0.305068
function float32(bytes, idx) {
    bytes = bytes.slice(idx || 0);
    bytes = int32_BE(bytes, 0)
    var sign = (bytes >> 31) == 0 ? 1 : -1; // Comparison with 0x80000000 fails on 32 bit systems!
    var exponent = ((bytes >> 23) & 0xFF) - 127;
    var significand = (bytes & ~(1 << 23));

    if (exponent == 128) {
        // Some systems might have issues with NaN and POSITIVE_INFINITY, e.g. JSON parsing in GoLang
        // return sign * ((significand) ? Number.NaN : Number.POSITIVE_INFINITY);
        return null;
    }

    if (exponent == -127) {
        if (significand == 0) return sign * 0.0;
        exponent = -126;
        significand /= (1 << 22);
    } else {
        significand = (significand | (1 << 23)) / (1 << 23);
    }

    return sign * significand * Math.pow(2, exponent);
}
function float32_BE(bytes, idx) { return float32(bytes, idx); }

/**
 * TTN decoder function.
 */
function Decoder(bytes, port) {
    var vals = {};
    if( port == 20 ){

```



```

        if (bytes.length==5) {
            // Pressure Probe without temperature sensor and Bridges internal Temperature
            vals["error"] = !(bytes[0]&0x80);
            vals["pressure"] = int16_BE(bytes, 1)/1000;
            vals["temperature"] = int16_BE(bytes, 3);
        } else if (bytes.length==7) {
            vals["error"] = !(bytes[0]&0x80);
            vals["pressure"] = int16_BE(bytes, 1)/1000;
            vals["temperature"] = int16_BE(bytes, 3);
            vals["voltage"] = uint16_BE(bytes, 5) / 1000;
        } else if (bytes.length==9) {
            vals["error"] = !(bytes[0]&0x80);
            // pressure in mH2O
            vals["pressure"] = float32_BE(bytes, 1);
            // temperature in Degree Celsius
            vals["temperature"] = float32_BE(bytes, 5);
        } else if (bytes.length==11) {
            vals["error"] = !(bytes[0]&0x80);
            // pressure in mH2O or Bar, depending on probe type
            vals["pressure"] = float32_BE(bytes, 1);
            // temperature in Degree Celsius
            vals["temperature"] = float32_BE(bytes, 5);
            vals["voltage"] = uint16_BE(bytes, 9) / 1000;
        }
    }

    if (port === 64 && bytes.length == 13) { // status packet
        vals["Firmware Identifier"] = String.fromCharCode(bytes[0]) + String.fromCharCode(bytes[1]) + String.fromCharCode(bytes[2]);
        vals["FirmwareVersion"] = bytes[3] + '.' + bytes[4] + '.' + bytes[5];
        vals["status"] = bytes[6];
        vals["reboot reason"] = bytes[7];
        vals["final words"] = bytes[8];
        vals["voltage"] = uint16_BE(bytes,9)/1000.0
        vals["temperature"] = int16_BE(bytes,11)/10.0;
    }
    return vals;
}

function NB_ParseModbusQuery(input){
    vals = {};

    for( var i = 0; i< input.d.batch.length; i++){
        if (input.d.batch[i].cmd == "AQMAFgAC"){
            vals["pressure"] = float32_BE(bytes(atob(input.d.batch[i].rsp)),3);
        }
        if (input.d.batch[i].cmd == "AQMAJgAC"){
            vals["temperature"] = float32_BE(bytes(atob(input.d.batch[i].rsp)),3);
        }

        // else: keller
        if (input.d.batch[i].cmd == "AQMAAgAC"){
            // convert to mH2O
            vals["pressure"] = float32_BE(bytes(atob(input.d.batch[i].rsp)),3)*10.197442889221;
        }
        if (input.d.batch[i].cmd == "AQMACAAC"){
            vals["temperature"] = float32_BE(bytes(atob(input.d.batch[i].rsp)),3);
        }

        // vbat
        if (input.d.batch[i].cmd == "+gQABQAB"){
            vals["vBat"] = int16_BE(bytes(atob(input.d.batch[i].rsp)),3)/1000.0;
        }

        // internal temperature
        if (input.d.batch[i].cmd == "+gQABAAB"){
            vals["temperatureInt"] = int16_BE(bytes(atob(input.d.batch[i].rsp)),3);
        }
    }

    return vals;
}

```

```

/**
 * TTN V3 Wrapper
 */
function decodeUplink(input) {
  return {
    data: {
      values: Decoder(input.bytes, input.fPort)
    },
    warnings: [],
    errors: []
  };
}

function NB_ParseDeviceQuery(input) {
  for (var key in input.d) {
    var v = input.d[key];
    switch (key) {
      case "temperature":
        v = v / 10.0;
        Device.setProperty("device.temperature", v);
        continue;
      case "vbat":
        v = v / 1000.0;
        Device.setProperty("device.voltage", v);
        continue;
    }
    Device.setProperty("device." + key, v);
  }
  return null;
}

function NB_ParseConfigQuery(input) {
  for (var key in input.d) {
    Device.setConfig(key, input.d[key]);
  }
  return null;
}

function NB_ParseStatusQuery(input) {
  NB_ParseDeviceQuery(input);
  return null;
}

/**
 * ChirpStack decoder function.
 */
function Decode(fPort, bytes) {
  // wrap TTN Decoder:
  return Decoder(bytes, fPort);
}

/**
 * Lobar Platform decoder function.
 */
function Parse(input) {
  if (input.i && input.d) {
    // NB-IoT
    var decoded = {};
    decoded = input.d;
    decoded.address = input.i;
    decoded.fCnt = input.n;

    var query = input.q || "data";

    switch (query) {
      case "config":
        return NB_ParseConfigQuery(input);
      case "device":
        return NB_ParseDeviceQuery(input);
      case "modbus":

```

```
        return NB_ParseModbusQuery(input);
    case "status":
        return NB_ParseStatusQuery(input);
    default:
    }
    return decoded;
}

var data = bytes(atob(input.data));
var port = input.fPort;
return Decoder(data, port);
}
```