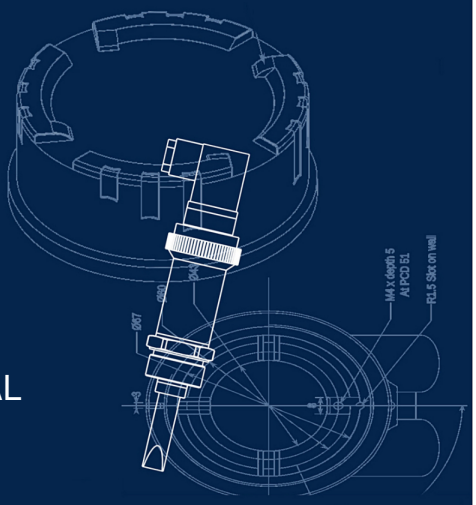
SAPCON

Grown...to meet challenges

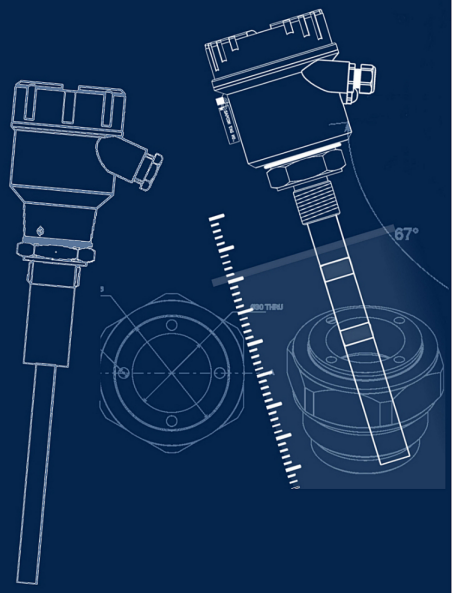


INSTRUCTION MANUAL

CAPVEL

Capacitance Level Transmitter

Version 2.0



SAPCON INSTRUMENTS PVT. LTD.

30+ Years in Process Control Instrumentation

An ISO 22000 company

www.sapconinstruments.com

Custom-built International Standard Products | 80,000+ Successful Installations | Exporting to 90+ Countries | 7500+ Clients

Contents

Revision History 5
1 Introduction 6
2 Operating Principle 6
3 Features 6
4 Applications 6
5 Electrical Specifications 6
6 Mechanical Specifications 7
7 Application Specifications 7
8 Installation & Handling Guidelines 8
9 Electrical Connections 8
10 Key Operations 8
11 Menu Configuration 9
11.1 Display Settings 9
11.2 Calibration Settings 9
11.3 Communication Settings 11
12 Modes of Calibration 12
12.1 Selecting Mode of Calibration 12
12.2 Comprehensive Calibration 12
12.2.1 Minimum System Requirements 13
12.3 MODBUS-Rtu Output 13
12.3.1 Modbus-Rtu Topology 14
12.3.2 Modbus-Rtu Register Table 14
13 Troubleshooting Process 22
14 Compatibility with Communication Gateways 22
15 Error Indication 23
16 Customer Support 24
17 Product Selection Order Code 24

List of Figures

1 Capvel Product Image 6
2 Part Description of Capvel 6
3 Proper Mounting Arrangement 8
4 Loop Power 8
5 4-Wire Connection 8
6 Shifting LCD Cursor 9
7 Incrementing Parameter Values 9
8 Back from Existing Window 9
9 Scroll 9
10 Saving Values 9
11 Error Message 9
12 Main Menu 9
13 Displayed Output Value List 9
14 Backlight Value 9
15 Low Calibration 10
16 Calibration Setting List 10
17 High Calibration 10
18 Calibration Setting List 10
19 Tank Setting List 11
20 Communication Setting List 12
21 Device ID 12
22 Example Modbus-Rtu Query Format 13
23 General 2-wire MODBUS-Rtu Topology 14

List of Tables

1 Electrical Specifications 6
2 Mechanical Specifications 7
3 Application Specifications 7
4 Modbus Table 1 15
5 Modbus Table 2 16
6 Modbus Table 3 17
7 Modbus Table 4 18
8 Modbus Table 5 19
9 Modbus Table 6 20
10 Modbus Table 7 21
11 Error Indication 23

Revision History

Revision	Date	Author(s)	Description
1.0	11th Feb 2021	RND	First Version Editing
1.1	17th Jun 2021	RND	Added Modbus Table
1.2	1st Sept 2021	RND	Added Capvel Application
2.0	15th July 2025	RND	Revised Format

[1]

[1]

- **Copyright:** All content on this document, such as text, graphics, logos and images is the property of Sapcon Instruments Pvt. Ltd. The selection, arrangement and presentation of all materials on this document and the overall design of this document is the exclusive property of Sapcon Instruments Pvt. Ltd.

- The images shown in this manual may differ from the actual instrument / housing in terms of dimensions, color and design. Please refer to GA drawings for dimensional details.
- Values (of performance) described in this manual were obtained under ideal testing conditions. Hence, they may differ under industrial environment and settings.

General Instructions

- Instrument shouldn't block the material filling inlet.
- Secure the cover of housing tightly. Tighten the cable glands. For side mounting, the cable glands should point downwards.
- For side mounting, provide a baffle to prevent the material from falling on the probe.
- When handling forks, do not lift them using their tines. While using them with solids, ensure that material size is less than 10mm.
- Deforming the shape of the tines may interfere with the fork's operating frequency.
- Make all electrical connections as instructed in the manual. Don't power on the device before verifying the connections.

1 Introduction

Capvel is a capacitive level transmitter for conductive or non-conductive free flowing liquids and granular materials that have stable dielectric constant. It is suitable for continuous level measurement in silos, bins, hoppers, etc. where the process temperature ranges between 0° C to +250° C. It addresses the material level continuously at a given time-frame to provide real-time outcomes.

Figure 1: Capvel Product Image

2 Operating Principle

The working principle of Capvel is based on capacitance measurement. Capacitance is formed between the level sensing probe and metallic wall which act as two electrodes, and the application media acts as a dielectric medium. When the level of process material rises, the value of dielectric changes which results change in capacitance value between the probe and the vessel wall. It utilizes a

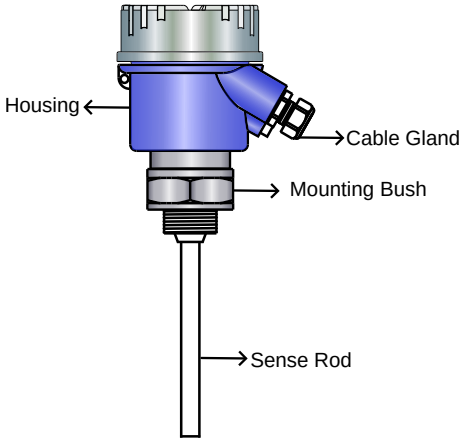


Figure 2: Part Description of Capvel

specially developed capacitance change gauging circuit and fast microcontroller to evaluate the changes of material level in different formats such as level in milli-meters, percentage and volume of process materials in milli-litres.

3 Features

- Power Supply: 9-30V DC(4-Wire) 24V DC(2-Wire).
- 4-20mA Analog Output (2Wire & 4Wire) Galvanically Isolated.
- OLED Display with 4 Keys.
- Different Display output configuration - percentage, Level, Volume.
- Enhanced Noise Performance
- Available with MODBUS-Rtu (RS-485) protocol.
- Ability to work with custom irregular shaped tanks.
- Special algorithm for compensating turbulence and temperature drift
- Temperature Compensation Algorithm.
- ESD and Surge Protection.

4 Applications

Capvel is particularly developed for applications where continuous level measurement is preferred. Some applications where Capvel is ideal choice are:

- Telecom Industries
- Water Treatment Plants
- Fuel Monitoring
- Oil & Refinery Manufacturing Units

5 Electrical Specifications

Pleas refer to Table 1 for Electrical Specifications.

PARAMETER	VALUE
Input Power Supply	9-30V DC(4-Wire) 24V DC(2-Wire)
Output	• 4-20mA (2Wire, 3Wire & 4Wire) • MODBUS-Rtu (RS-485)-(4Wire Only)
Ambient Temperature (Electronics)	$0°C$ - $60°C$
Power Consumption	$\leq 1.0W$ @ 24V
Indication	OLED Display

Table 1: Electrical Specifications

6 Mechanical Specifications

Please refer to Table 2 for Mechanical Specifcations.

PARAMETER	VALUE
Housing	• SCUTE: Pressure Die Cast Aluminium, weatherproof, powder-coated, IP68 • FP2C: Cast Aluminium, weather & flameproof, IEC 60079-1 Ex 'd',„ powder-coated suitable for gas group IIC, IP66/68 • CLB: Weatherproof plastic housing with transparent cover for LED illumination, Rating IP68/IP66, Material : PBT-FR & PC
Mounting	• Screwed: 1/2",1",1 1/2", 3/4",2" (BSP/NPT) • Flange: ANSI, DIN, EN, JIS, Custom
Electrical Connector	2 x 1/2" BSP/NPT(SC/DC), PG 13.5, M20
Probe Length	• 100 mm to 3000 mm (Rod version) • 500 mm to 20000 mm (Rope version)
Insulation	Full PTFE ,Ceramic
Operating Temperature	Up to $60°C$
Process Temperature	Up to $250°C$
Operating Pressure	Up to 25bar(g)

Table 2: Mechanical Specifications

7 Application Specifications

Please refer to the Table 3 for Application Specifications.

PARAMETER	VALUE
Measurement Span	16 to 3000 pF above zero
Accuracy	+/- 1% FSL or better
Resolution	Adjustable (minimum +/- 1mm)
Temperature Drift	$800 ppm/°C$

Table 3: Application Specifications

8 Installation & Handling Guidelines

While installing the instrument, please take care of the following points:

- The instrument should be installed in vertical position only.

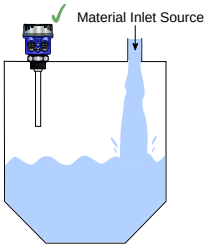


Figure 3: Proper Mounting Arrangement

- The instrument shouldn't block the material filling inlet.
- Secure the cover of housing tightly. Tighten the cable glands.
- Make all electrical connections as instructed in the Electrical Connections section. Don't power on the device before verifying the connections.
- Weatherproofness of enclosure is guaranteed only if the cover is in place glands adequately tightened. Damage due to accidental entry of water can be avoided if the instrument is installed in a rain shade.
- If the ambient temperature is high, the instrument should not be installed to receive direct sunlight. In case such a position of shade is not available, a heat shield should be fitted above the instrument especially if the operating temperature lies between 60°C and 80°C.
- While screwing the instrument, the hexagonal mounting bush should be turned and not the housing.

9 Electrical Connections

Electrical connections for the instrument will change with the models. Please refer to Figure 4 and 5 to connect the device.

10 Key Operations

Capvel introduces LCD display to ease the configuration process. The main menu parameters of LCD can be accessible through 4 keys (ESC, UP, DOWN and ENTER).

- **Shift Cursor:** LCD cursor can be shifted or selected using UP key as shown in the Figure 6.
- **Increment Values:** Select the values as described in Figure 6 and increment it using DOWN key as shown in the Figure 7.
- **Back:** To exit from the existing window, ESC key can be used as shown in Figure 8.

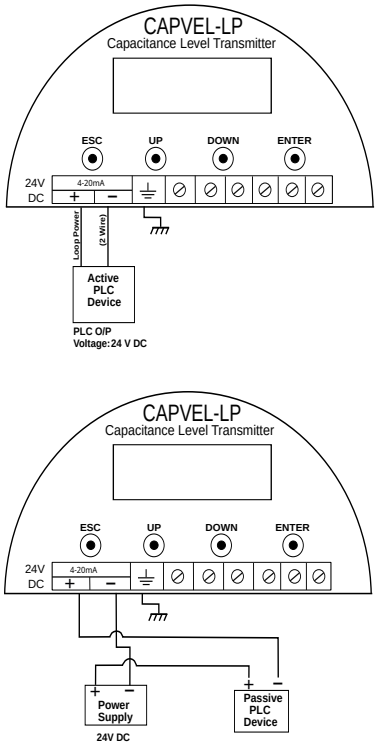


Figure 4: Loop Power

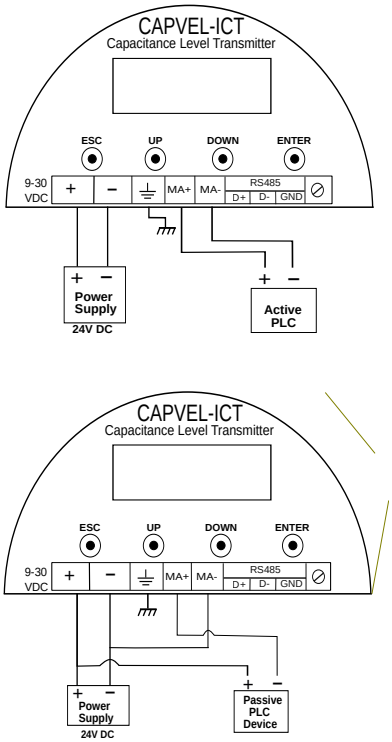


Figure 5: 4-Wire Connection

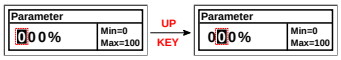


Figure 6: Shifting LCD Cursor

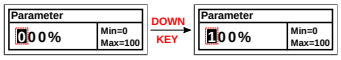


Figure 7: Incrementing Parameter Values

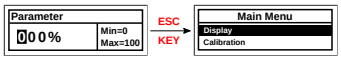


Figure 8: Back from Existing Window

- **Scroll:** Main menu list can be scrolled using UP and DOWN keys as describe in Figure 9.

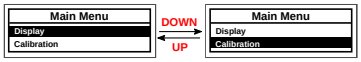


Figure 9: Scroll

- **Save Values:** To save values of any parameter or open any menu settings, ENTER key can be used as shown in Figure 10.

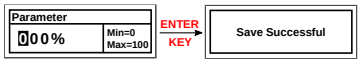


Figure 10: Saving Values

- **Error Message:** If values are set beyond the specified limit of any parameter then an error message is displayed on the LCD screen as shown in Figure 11.

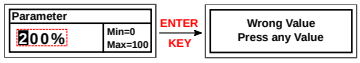


Figure 11: Error Message

11 Menu Configuration

Array of parameters can be set using LCD Display and 4 Keys. The following values can be modified by accessing the main menu as shown in the Figure 12.

- Display Settings
- Calibration Settings
- Communication Settings
- Service Settings
- Debug Settings
- Product Info

11.1 Display Settings

Through display menu option, change the values of **"Displayed Value"** and **"Brightness"**.

Displayed Value Configuration: Follow the instruction given below to adjust the value of output.

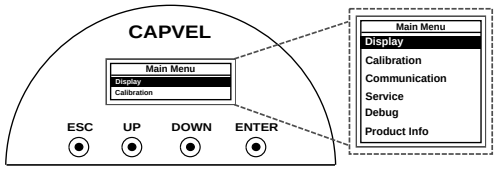


Figure 12: Main Menu

- Select **Display** option and press ENTER key to open.
- Choose any one options from available output using UP & DOWN key.
  - Percent
  - Tank Fill Level
  - Probe Dip Level
  - Volume
- Press ENTER to save it.

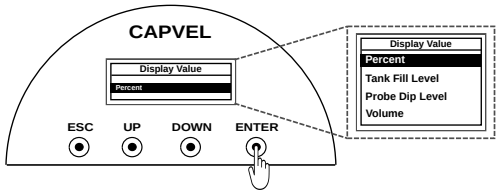


Figure 13: Displayed Output Value List

Backlight Adjustment: Follow the instruction given below to adjust the brightness of LCD screen.

Note: Set the value of Backlight between range:

- Min: 0
- Max: 100

- Select **Display** option and press ENTER key to open.
- Select **Backlight** option and press ENTER.
- Shift and increment the values as shown in Key Operations section.
- Edit the value and press ENTER to save it.

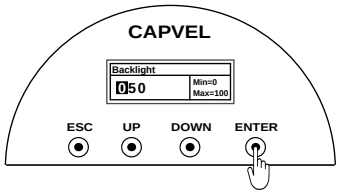


Figure 14: Backlight Value

- Ensure that the value should be enter within the specified limit otherwise error message will be shown as shown in Figure 11.

11.2 Calibration Settings

Calibration settings can be useful to calibrate the instrument at **High and Low Points**, setting **Probe Length**, **Tank Setting**, **Turbulence**, and **Accuracy**.

Low Calibration: For Low Calibration, fill the tank with the application material such that it touches the tip of instrument's probe as shown in Figure 15 and follow the instructions given below:

Note: Set the value of Low Calibration between:

- Min: 0
- Max: 40

Value indicates percentage of probe dipped in an application material whose ideal low calibration point will be at 0%.

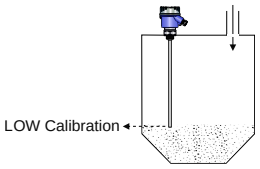


Figure 15: Low Calibration

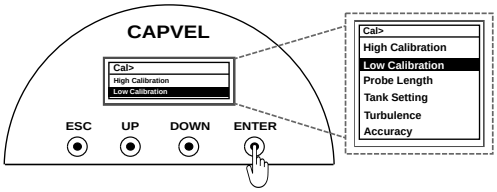


Figure 16: Calibration Setting List

- Select **Calibration** option from main menu and press ENTER to open.
- List of calibration setting will be appear on the screen as shown in Figure 16.
- Press DOWN key to select Low Calibration option and press ENTER to open it.
- Shift and increment the values as shown in Key Operations section.
- Edit the values and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot stored & display error as shown in Figure 11.
- Low Calibration is completed.

High Calibration: For High Calibration, fill the tank with the application material such that the instrument's probe is completely covered with the material as shown in Figure 17 and follow the instructions given below.

Note: Set the value of High Calibration between:

- Min: 60
- Max: 100

Value indicates percentage of probe dipped in an application material whose ideal high calibration point will be at 100%.

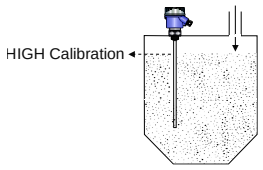


Figure 17: High Calibration

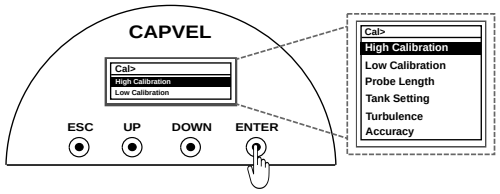


Figure 18: Calibration Setting List

- Select **Calibration** option and press ENTER to open.
- List of calibration setting will be appear on the screen as shown in Figure 18.
- Select High Calibration option and press ENTER to open.
- Shift and increment the values as shown in Key Operations section.
- Edit the values and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot stored and display an error as shown in Figure 11.
- High Calibration is completed.

Probe Length: Follow the instructions given below to set the probe length value:

Note: Set the value of Probe Length between:

- Min: 137
- Max: 20000

- Select **Calibration** option and press ENTER to open.
- List of calibration setting will be appear on the screen as shown in Figure 16.
- Press DOWN key to select Probe Length option and press ENTER to open.
- Shift and increment the values as shown in Key Operations section.
- Edit the value and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot be stored and display an error as shown in Figure 11.

Tank Setting: Follow the instructions given below to set the tank profile value:

- Select **Calibration** option and press ENTER to open.

- List of calibration setting will be appear on the screen as shown in Figure 16.
- Press DOWN key to select Tank Setting option and press ENTER to open.
- List of Tank Settings parameter will be appear on the LCD screen as shown in Figure 19.

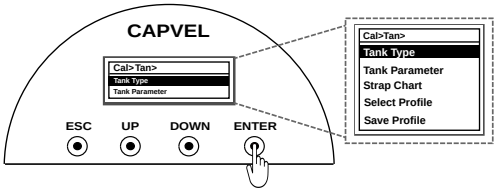


Figure 19: Tank Setting List

– **Tank Type:** Select the tank type from the following available options and press ENTER to save it.
  - ⋆ Horizontal Cylinder
  - ⋆ Vertical Cylinder
  - ⋆ Rectangular
  - ⋆ Horizontal Oval
  - ⋆ Vertical Oval
  - ⋆ Custom

– **Tank Parameter:** Set the values of tank parameters from the available options and press ENTER to save it.
  - ⋆ Tank Length
  - ⋆ Tank Height
  - ⋆ Tank Side Length
  - ⋆ Tank Width
  - ⋆ Tank Diameter
  - ⋆ Tank Nozzle
  - ⋆ Mounting Distance

– **Strap chart:** Only available with Custom Tank Selection.
  - ⋆ Strap Size
  - ⋆ Input Table
  - ⋆ Output Table
  - ⋆ Volumetric Calibration

– **Select Profile:** Select previously saved tank profile..

Note: Current Tank Settings will be replaced by selected profile. Save settings to one of the profile, if required.

  - ⋆ Profile 1
  - ⋆ Profile 2
  - ⋆ Profile 3
  - ⋆ Profile 4
  - ⋆ Profile 5

– **Save Profile:** Save current tank profile to one of the 5 available options.
  - ⋆ Profile 1
  - ⋆ Profile 2
  - ⋆ Profile 3
  - ⋆ Profile 4
  - ⋆ Profile 5

- Shift and increment the values as shown in Key Operations section.
- Press ENTER to save the values.
- Ensure that the values should be entered within the specified limit otherwise it won't save the value and shows the error message as shown in Figure 11.

Turbulence: Follow the instructions given below to set Turbulence value:

Note: Set the value of Turbulence between:
- Min: 1
- Max: 10

- Select **Calibration** option and press ENTER to open.
- List of calibration setting will be appear on the screen as shown in Figure 16.
- Press DOWN key to select Turbulence option and press ENTER to open.
- Shift and increment the values as shown in Key Operations section.
- Edit the value and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot be stored and display an error as shown in Figure 11.

Accuracy: Follow the instructions given below to set Accuracy:

Note: Set the value of Accuracy between:
- Min: 1
- Max: 20

- Select **Calibration** option and press ENTER to open.
- List of calibration setting will be appear on the screen as shown in Figure 16.
- Press DOWN key to select Accuracy option and press ENTER to open.
- Shift and increment the values as shown in Key Operations section.
- Edit the value and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot be stored and display an error as shown in Figure 11.

11.3 Communication Settings

Communication settings can be useful to set the **Device ID**, **Modbus ID** and **Baud Rate**.

Device ID: Follow the instructions given below to set Device ID:

Note: Set the value of Device ID between:

- Min: A
- Max: Z

- Select **Communication** option and press ENTER to open.
- List of communication setting will be appear on the screen as shown in Figure 20.

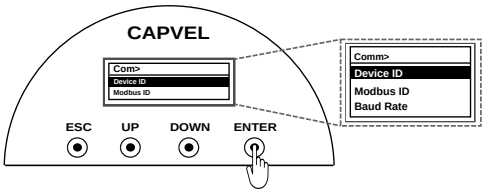


Figure 20: Communication Setting List

- Select Device ID option and press ENTER to open.
- Use UP and DOWN keys to select Device ID between A-Z.
- Select the Device ID and press ENTER to save it as shown in Figure 21.

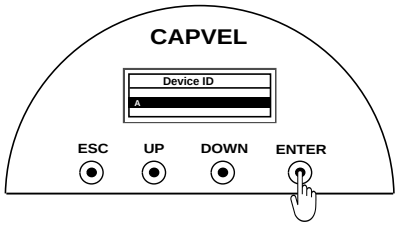


Figure 21: Device ID

Modbus ID: Follow the instructions given below to set Modbus ID:

- Select **Communication** option and press ENTER to open.
- List of communication setting will be appear on the screen as shown in Figure 20.
- Press DOWN key to select Modbus ID option and press ENTER to open.
- Edit the value and press ENTER to save it.
- Ensure that the value should be enter within the specified limit otherwise values cannot be stored and display an error as shown in Figure 11.

Baud Rate: Follow the instructions given below to set Baud Rate:

- Select **Communication** option and press ENTER to open.
- List of communication setting will be appear on the screen as shown in Figure 20.
- Press DOWN key to select Baud Rate option and press ENTER to open.
- Edit the value and press ENTER to save it.

Service and Debug Setting options is only available for Sapcon's Engineers.

12 Modes of Calibration

- Menu Configuration
- **Recommended:** Comprehensive Calibration with Volume Configuration (Using Desktop Application Software)
- MODBUS-Rtu Output

12.1 Selecting Mode of Calibration

The calibrator box helps select the mode of operation using a switch key. The switch can be moved left or right.

'Right' Switch Position
The right position of switch is described using the icon of a desktop system on the calibrator box. When the switch is moved to the right, the 'Comprehensive' calibration mode is selected. This mode requires the desktop application software setup provided with the sensor.

This mode allows selecting a tank type, saving tank configuration profiles (length, width, height, diameter) and calibrating 'High Level' and 'Low Level' of the sensor. The desktop application helps to correctly setup volume output and also perform advanced configuration.

12.2 Comprehensive Calibration

This mode requires the desktop application software setup along with a USB and a calibrator box. This mode allows selecting tank type, saving tank configuration profiles (length, width, height, diameter) and calibrating 'High Level' and 'Low Level' of the sensor.

Please contact Customer Support to receive the latest software setup.

- Please refer to Section Electrical Connections for electrical wiring connections.
- Check System Requirements as mentioned in Section Minimum System Requirements
- Connect the calibrator with the sensor.
- For using this mode, move the switch on the calibrator box to the right. This will select the 'Comprehensive / Application Software' mode which is also described using the desktop icon on the calibrator box.

- Use a micro-USB to USB cable commonly used for charging smartphones / tablets. One end of the USB will be connected with the calibrator box in the 'USB' slot. The other end of the USB will be connected to the desktop which will run the software setup.
- Download and install Virtual Comport Driver from FTDI. Select the correct and latest driver as per your operating system and processor architecture (32-bit or 64-bit). http://www.ftdichip.com/Drivers/VCP.htm
- Refer to Virtual installation COM Port guides at http://www.ftdichip.com/Support/Documents/InstallGuides.htm.
- Please also refer to the installation guide at: Installation_Guide_for_Windows7.pdf
- Specify the driver location for the driver to work.
- Please restart the system.
- Please download and install the application software setup provided with Capvel sensor.

12.2.1 Minimum System Requirements

- **Operating System:** Microsoft XP SP3, Windows 7, Windows 10, Ubuntu (Setup available on request)
- **RAM:** 1GB
- 1 USB Port

12.3 MODBUS-Rtu Output

MODBUS©Protocol is a messaging structure, widely used to establish master-slave communication between intelligent devices. A MODBUS message sent from a master to a slave contains the address of the slave, the 'command' (e.g. 'read register' or 'write register'), the data, and a check sum (LRC or CRC). Since Modbus protocol is just a messaging structure, it is independent of the underlying physical layer, for Capvel RS-485 has been used as a physical layer. MOSBUS-Rtu serves as the primary output for Capvel.

Before going live, test and verfiy the MODBUS-Rtu output by following the steps mentioned below.

1. Please use a standard MODBUS-Rtu sofware of your choice or chose from the following:
   - Modbus Poll(tested)
   - QModbus Master
   - There are several libraries such as libmodbus, Qt, etc. with which you can build a app of your own.
2. Electrical Connections for Capvel are as per Section Electrical Connections.
3. RS-485 Communication Settings: The default settings if the device are mentioned below, these need to be fed to the MODBUS-Rtu software:
   - Baudrate: 9600, Data Bits: 8, Parity: None, Stop Bits: 1.
   - Baudrate is configurable, please refer to the 'Developer API' section for more.
4. Identify output and internal measurement parameters of interest from Table 4,5,6,7,8,9,10.
5. Note that some parameters such a *volume in mili-liters* correspond to two 16-bit register locations, representing LSB and MSB. Data from these registers needs to be combined before converting to decimal notation.
6. It is recommended that all registers given in Figure 22 be queried. Ideally this should be done using a single query, as shown in Figure 22.

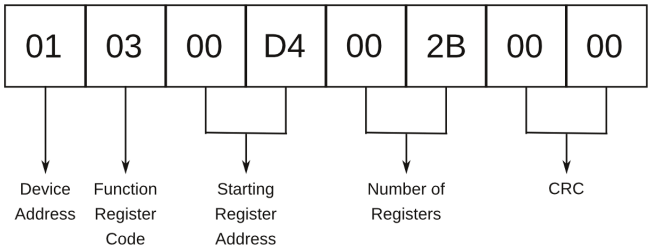


Figure 22: Example Modbus-Rtu Query Format

Note:
Querying all registers help Sapcon's support team to locate a configuration issue immediately from a remote location.

7. A detailed explanation of MODBUS-Rtu is out of the scope of the product manual. Please refer to protocol standards for more details.
8. Impedance Matching: If all the above has been correctly configured and problem persists, it is likely that impedance matching will have to be performed.
9. Testing Sofware: Before going live with a modem as the Modbus-Rtu master, use debugging software such as Modbus Poll on a desktop/laptop to verify communication with Capvel. Capvel Calibrator can be used as a converter from USB to RS-485.

12.3.1 Modbus-Rtu Topology

The following figure represents a general MODBUS-Rtu topology for 2-wire connection.

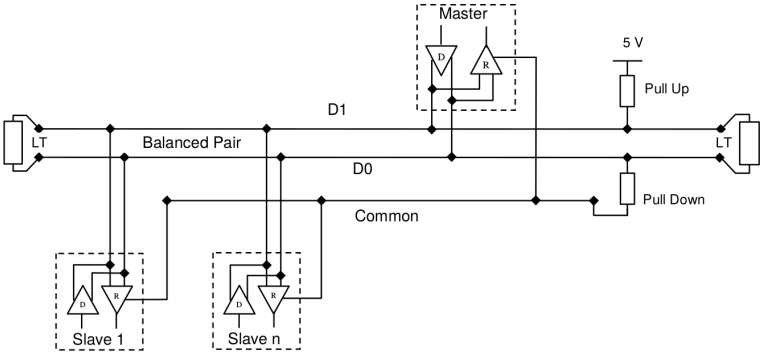


Figure 23: General 2-wire MODBUS-Rtu Topology

12.3.2 Modbus-Rtu Register Table

Please refer to Table 4,5,6,7, 8, 9,10 for a detailed description of the modbus register.

Note:
For 16-bit registers such as Volume(214-215), MSB (Most Significant Byte) and LSB (Least Significate Byte) have to be concatenated before representing their data in decimal format.

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Level (In mm)	001	Live	Read Only	Unsigned int 16 bit	-	-
Percent Output	002	Live	Read Only	Unsigned int 16 bit	-	-
Volume (In litre)	003-004	Live	Read Only	Unsigned int 32 bit	-	-
Tank Profile	005	Saved	Read Only	Unsigned int 16 bit	1 to 5	Current tank Profile
Tank Profile	006	Saved	Read/Write	Unsigned int 16 bit	1 to 5	Writing to this register will select tank profile.
Tank Profile	007	Saved	Read/Write	Unsigned int 16 bit	1 to 5	Writing to this register will save current tank profile.
Strap Table Size	008	Saved	Read/Write	Unsigned int 16 bit	1 to 64	-
Volumetric Calibration	009	Saved	Read/Write	Unsigned int 16 bit	0 or 1	• 0 – Disable Volumetric Calibration • 1 – Enable Volumetric Calibration
Strap Input 1	010	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 2	011	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 3	012	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 4	013	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 5	014	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 6	015	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 7	016	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 8	017	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 9	018	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 10	019	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 11	020	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 12	021	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 13	022	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 14	023	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 15	024	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 16	025	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 17	026	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 18	027	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 19	028	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 20	029	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 21	030	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm

Table 4: Modbus Table 1

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Strap Input 22	031	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 23	032	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 24	033	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 25	034	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 26	035	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 27	036	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 28	037	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 29	038	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 30	039	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 31	040	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 32	041	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 33	042	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 34	043	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 35	044	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 36	045	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 37	046	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 38	047	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 39	048	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 40	049	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 41	050	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 42	051	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 43	052	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 44	053	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 45	054	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 46	055	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 47	056	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 48	057	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 49	058	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 50	059	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 51	060	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 52	061	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 53	062	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 54	063	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 55	064	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 56	065	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 57	066	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm

Table 5: Modbus Table 2

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Strap Input 58	067	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 59	068	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 60	069	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 61	070	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 62	071	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 63	072	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Strap Input 64	073	Saved	Read/Write	Unsigned int 16 bit	1 to 20000	Level in mm
Reserved	074 – 079					
Strap Output 1	080	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 2	081	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 3	082	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 4	083	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 5	084	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 6	085	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 7	086	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 8	087	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 9	088	Saved	Read/Write	unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 10	089	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 11	090	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 12	091	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 13	092	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 14	093	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 15	094	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 16	095	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 17	096	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 18	097	Saved	Read/Write	unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 19	098	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 20	099	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 21	100	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 22	101	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 23	102	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 24	103	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 25	104	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 26	105	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 27	106	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 28	107	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre

Table 6: Modbus Table 3

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Strap Output 29	108	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 30	109	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 31	110	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 32	111	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 33	112	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 34	113	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 35	114	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 36	115	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 37	116	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 38	117	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 39	118	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 40	119	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 41	120	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 42	121	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 43	122	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 44	123	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 45	124	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 46	125	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 47	126	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 48	127	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 49	128	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 50	129	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 51	130	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 52	131	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 53	132	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 54	133	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 55	134	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 56	135	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 57	136	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 58	137	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 59	138	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 60	139	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 61	140	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 62	141	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 63	142	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre
Strap Output 64	143	Saved	Read/Write	Unsigned int 16 bit	1 to 65000	Volume in litre

Table 7: Modbus Table 4

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Reserved	144 - 149	-	-	-	-	-
System Restart	150	Saved	Write	Unsigned int 16 bit	001	Writing 1 will restart the instrument
Reserved	151 - 187	-	-	-	-	-
Output mA	188	Live	Read Only	Unsigned int 16 bit	-	-
mm Count	189	Saved	Read Only	Unsigned int 16 bit	-	-
Per pf Count	190	Saved	Read Only	Unsigned int 16 bit	-	-
Baud Rate	191	Saved	Read/Write	Unsigned int 16 bit	0 to 4	Baud Rate: • 0: 4800 • 1: 9600 • 2: 19200 • 3: 38400 • 4: 57600
Modbus ID	192	Saved	Read/Write	Unsigned int 16 bit	1 to 247	Device modbus ID
Serial PWM Flag	193		Read /Write	Unsigned int 16 bit	0 or 1	• 0 – Disable controlling of analog output through communication • 1 – Enable controlling of analog output through communication
Low Calibration	194	-	Write	Unsigned int 16 bit	0 to 40	Perform low scale calibration at written value
High Calibration	195	-	Write	Unsigned int 16 bit	60 to 100	Perform high scale calibration at written value
Factory Low Calibration	196	-	Write	Unsigned int 16 bit	0 to 40	Perform factory low scale calibration at written value
Factory High Calibration	197	-	Write	Unsigned int 16 bit	60 to 100	Perform factory high scale calibration at written value
Copy Factory Calibration	198	-	Write	Unsigned int 16 bit	001	Writing 1 will copy factory calibration
Default Setting	199	-	Write	Unsigned int 16 bit	001	Writing 1 will set default setting
Effective Probe Length	200	Saved	Read Only	Unsigned int 16 bit	-	Effective probe length in mm.
Reserved	201		-	-	-	-
Tank Fill Level	202	Saved	Read Only	Unsigned int 16 bit	-	Tank fill level in mm
Percent Output	203	Live	Read Only	Unsigned int 16 bit	-	-
Level (in mm)	204	Live	Read Only	Unsigned int 16 bit	-	-
Reserved	205	-	-	-	-	-

Table 8: Modbus Table 5

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Display Parameter	206	Saved	Read /Write	Unsigned int 16 bit	1 to 4	• 1: Percentage output displayed on LCD • 2: Tank level displayed on LCD • 3: Level output displayed on LCD • 4: Volume output displayed on LCD Display backlight
Display Backlight	207	Saved	Read /Write	Unsigned int 16 bit	1 to 100	Percentage backlight
Failure Current	208	Saved	Read /Write	unsigned int 16 bit	0 or 1	• 0: For 22 mA • 1: For 3.8 mA
mA Direction	209	Saved	Read /Write	Unsigned int 16 bit	0 or 1	• 0: For 4 mA ..... 20 mA • 1: For 20 mA ..... 4 mA
Analog Output Type	210	Saved	Read /Write	Unsigned int 16 bit	0 to 1	• 0: For 0 to 5V output • 1: For 4-20 mA output
PWM Count	211	Live	Read Only	Unsigned int 16 bit		Current pwm counts
Percent Output	212	Live	Read Only	Unsigned int 16 bit	-	
Voltage Output (mV)	213	Live	Read Only	Unsigned int 16 bit	-	
- Volume (in millilitre)	214 / 215	Live	Read Only	Unsigned int 32 bit		MSB-add / LSB-add
Level (in mm)	216	Live	Read Only	unsigned int 16 bit	-	
Low Calibration Count	217 / 218	Saved	Read /Write	Unsigned int 32 bit		MSB-add / LSB-add
High Calibration Count	219 / 220	Saved	Read/Write	Unsigned int 32 bit		MSB-add / LSB-add
Scale Low	221	Saved	Read /Write	Unsigned int 16 bit	0 to 40	Low scale calibration value in percent
Scale High	222	Saved	Read /Write	Unsigned int 16 bit	60 to 100	High scale calibration value in percent
Ref1 Calib Count	223 / 224	Saved	Read /Write	Unsigned int 32 bit		MSB-add / LSB-add

Table 9: Modbus Table 6

PARAMETER	ADDRESS	TYPE	READ/WRITE	DATA TYPE	RANGE	NOTE
Ref2 Calib Count	225 / 226	Saved	Read /Write	Unsigned int 32 bit		MSB-add / LSB-add
High Pwm Count	227	Saved	Read /Write	Unsigned int 16 bit	10 - 32000	Analog high count
Low Pwm Count	228	Saved	Read/Write	Unsigned int 16 bit	10 - 32000	Analog low count
Fault	229	Live	Read Only	Unsigned int 16 bit		Fault number
Probe Length	230	Saved	Read /Write	Unsigned int 16 bit	100 - 20000	Probe length in mm
Accuracy	231	Saved	Read /Write	unsigned int 16 bit	1 to 20	Accuracy in mm
Temperature	232	Live	Read Only	unsigned int 16 bit		
Turbulence	233	Saved	Read /Write	unsigned int 16 bit	0 to 10	
Nozzle Length	234	Saved	Read /Write	unsigned int 16 bit	Tank nozzle	Length in mm
Tank Length	235	Saved	Read /Write	unsigned int 16 bit		Tank length in mm
Tank Diameter	236	Saved	Read /Write	unsigned int 16 bit		Tank diameter in mm
Tank Height	237	Saved	Read /Write	unsigned int 16 bit		Tank height in mm
Tank Width	238	Saved	Read /Write	unsigned int 16 bit		Tank width in mm
Tank Side	239	Saved	Read /Write	unsigned int 16 bit		Tank side length in mm
Tank Type	240	Saved	Read /Write	unsigned int 16 bit	0 to 5	• 0: Horizontal Cylinder • 1: Vertical Cylinder • 2: Rectangle • 3: Horizontal Oval • 4: Vertical Oval • 5: Custom Tank
Ref1 Mean Count	241 / 242	Live	Read only	Unsigned int 32 bit		MSB-add / LSB-add
Ref2 Mean Count	243 /244	Live	Read only	Unsigned int 32 bit		MSB-add / LSB-add
Sense Mean Count	245 / 246	Live	Read only	Unsigned int 32 bit		MSB-add / LSB-add
Sense Filter Count	247 / 248	Live	Read only	Unsigned int 32 bit		MSB-add / LSB-add
Sense Final Count	249 / 250	Live	Read only	Unsigned int 32 bit		MSB-add / LSB-add
Tank Mount Distance	251	Saved	Read /Write	Unsigned int 16 bit	-	-
Tank Capacity	252 / 253	Saved	Read only	Unsigned int 32 bit	-	MSB-add / LSB-add
Firmware Version	254	Saved	Read only	Unsigned int 16 bit	-	-

Table 10: Modbus Table 7

13 Troubleshooting Process

If Capvel is not responding to MODBUS queries as expected, the following troubleshooting steps should be followed. Identify and narrow down on specific issue(s) out of the list with the solutions mentioned.

Identify your problem

1. Intermittent Response Time Out Error or Intermittently not responding to a query.
    - Try increasing the response time out of the Modbus-Rtu master to 5000ms.
    - There could be an impedance mismatch between the gateway, bus and .

2. Capvel does not respond to a valid query made from a specific Modbus-Rtu Master/Gateway, but responds to other Masters -
    - The Modbu-RTU Master/Gateway could be malfunctioning. Replace the device if possible.
    - There could be an impedance mismatch between the gateway, bus and Capvel. Try matching the impedance of the bus by placing terminations resistances of 120 ohms between A and B. Also refer to Modbus-Rtu specifications for more details on adding termination resistances.

3. Capvel does not respond to a valid query made from any Master/Gateway.
    - Connect device to its desktop application on the laptop via Sapcon's Calibrator. Check if the application successfully connects to the fuel sensor with different Baudrates. Restore to factory settings and check communication again. Verify details on default communication settings.
    - Please refer to Table 11 and fix the error as per the LED indication being observed. Then, try communicating with the device again.

4. A slave device is not responding when connected on the same bus with a specific slave or group of slaves.
    - Check if each slave on the bus has a unique Modbus-ID. A duplicate slave IDs can cause communication errors.
    - A particular slave could be causing the standalone voltage level on the bus to change. Check voltage standalone voltage level on the bus.

5. Capvel does not respond with longer RS-485 cables or an echo of Modbus query is observed instead of a response.
    - This is likely due to impedance mismatch, try matching bus impedance.
    - Bus topology guidelines of the Modbus-Rtu specification should be followed.
    - If problem persists, RS-485 repeaters might have to be used for longer lengths (>250m).

6. CRC Error and Other Fixes
    - Check if there is a change in voltage levels on the bus between "A and Common" and "B and Common".

14 Compatibility with Communication Gateways

capvel can be connnected to communication in two possible ways:

- with Modbus-Rtu as a slave device **(**Recommended)
- with Analog Voltage Output **(**Max. current load of $10\mu A$)

For details on connecting and configuring a Communication Gateway, please refer to the gateway's installation manual provided by the manufacturer.

There are tried and tested communication gateways based on Modbus-Rtu which have been configured as per Modbus Register Table 8. Please contact our sales team at sales@sapcon.in for a list of such devices.

15 Error Indication

In Capvel, errors are indicated for operators mishandling of the instrument in the view of instrument protection and proper setting of the instrument. On encountering any Error(s), the LCD display starts displaying with ERROR command with error name. To avoid errors, please:

- Ensure that all the connections are proper.
- Ensure that the instrument is mounted correctly and fitted tightly.
- During calibration, Capvel should be on high/low point of probe.

ERROR CODE	ERROR	DESCRIPTION	LCD DISPLAY	TROUBLESHOOTING
0	No Error	Instrument with no error	No Error	No error.
1	Probe Open	Probe open	Probe Open Error	Remove electronic insert from the housing and check connector connection with the probe.
2	Probe Short	Probe short-circuit	Probe Short Error	Moisture deposition in the probe connector. Clean the connector and use the instrument.
3	Calibration Error	Calibration error	Calibration Error	Recalibrate the instrument, make sure that probe is calibrated in an empty metallic tank.
4	Overflow	Level above 100%	Overflow	Capacitance is much more higher than calibrated capacitance range.
5	Underflow	Level below 0%	Underflow	Capacitance is much more less then the calibrated capacitance range.
6	Reference Open	Internal Reference got open circuited	Reference Open Error	Internal Fault in Sensor.
7	Reference Short	Internal Reference got short circuited	Reference Short Error	Internal Fault in Sensor.
8	Oscillator Fail	Oscillations Stop	Oscillation Error	Internal Fault in Sensor.

Table 11: Error Indication

16 Customer Support

Thank you for going through the instructions given in this manual. To further ease the process of installation and use, we have developed special demo videos which are hosted on YouTube.

Sapcon's YouTube channel, SAPCON INSTRUMENTS, lists all these videos: https://goo.gl/dnxfcz

Should you require further information regarding installation, use or working of the instrument, please don't hesitate to contact us. Kindly provide the following information at the time of contacting:

- Instrument Model and Serial Number
- Purchase Order Number and Date of Purchase
- Description of the query
- Your contact details

In an attempt to serve you better, we are open seven days a week (9:30am to 7:30pm). We are available at:

- www.sapconinstruments.com
- sales@sapcon.in
- +91-731-4757575

17 Product Selection Order Code

Version	Date	Modification	Modified By
V-1.4	18/10/19	Rope Weight added	Ashwin Morwal
V-1.5	15/02/20	R6S6 & R6S6J added	Ashwin Morwal
V-1.6	22/07/23	Capvel_LP removed	Aparna Shendurnikar
V-2.0	28/07/25	Capvel_LP& ICT add Tech data,remove fuel data	Prajakta Deokar

Product

Capvel: Capacitance Type Indicator Control Transmitter (For Conductive or Non-Conductive Liquids, Slurries Powdered Compounds)

Type

- I : Integral (sensor in the same unit)

Housing

- FP2C : Cast Aluminium, weather & flameproof, IEC 60079-1 Ex 'd', powder-coated suitable for gas group IIC, IP66
- SCUTE :Pressure die-cast aluminium, weatherproof, power-coated, IP68
- CLB :Weatherproof plastic housing with transparent cover for LED illumination, Rating IP68/IP66, Material:PBT-FR & PC

Probe Housing Cable Entry

- PCPG13 : Threaded, PG 13.5 cable gland, Polyamide (SCUTE)
- PC20 : Threaded, M20 gland, Polyamide (CLB)
- PCB5D : Threaded, G ½" (BSP), DC gland, Brass(Ni plated) (CLB,FP2C)
- PCN5D : Threaded, ½" NPT, DC gland, Brass (Ni plated) (CLB)

Output

- 4MAMP : 4-20mA Current Loop 4 wire transmitter (Max. 750 ohms) over current safe, MODBUS RTU RS-485, and compatible with PLC and SCADA Analog Inputs
- 2MAMP : 4-20mA Current Loop transmitter (Max. 500 ohms) over current safe and compatible with PLC and SCADA Analog Inputs

Power Supply

- DC5 : 9 To 30VDC (4MAMP)
- DC4 : 24VDC (2MAMP)

Reference(Optional)

- REF : YES(C)
- STWGI : Still Well, GI (RDP)
- STWS4 : Still Well, SS 304 (RDP)
- STWS6 : Still Well, SS 316 (RDP)

Probe Type

- RDP : Rod Probe
- ROP : Rope Probe

Rope Type (ROP)

- R6S6J : ø6 Wire Rope, SS 316, PTFE Jacketed (F)
- R6S6 : ø6 Wire Rope, SS 316
- R8S6 : ø8 Wire Rope, SS 316
- R8S4 : ø8 Wire Rope, SS 304
- R8GI : ø8 Wire Rope, GI(Galvanized Iron)

Mounting

- MB15MS : Threaded, G 1½" (BSP), MS Plated
- MN15MS : Threaded, NPT 1½", MS Plated
- MB15S4 : Threaded, G 1½" (BSP), SS 304

Mounting

- MN15S4 : Threaded, NPT 1", SS 304
- MB15S6 : Threaded, G 1½" (BSP), SS 316
- MN15S6 : Threaded, NPT 1½", SS 316
- TC10S6 : 1" Tri-Clamp ISO 2852/DIN 32676(DN25), SS 316 (Still Well)
- TC15S6 : 1½" Tri-Clamp ISO2852/DIN32676(DN40), SS 316
- TC20S6 : 2" Tri-Clamp ISO2852/DIN32676(DN50), SS 316
- F15S4 : 10 mm thick Flange conforming to 1½" ANSI/ASME B16.5 Flange
- F15S6 : 10 mm thick Flange conforming to 1½" ANSI/ASME B16.5 Flange, SS 316
- FA15MS : 1½" ANSI/ASME B16.5 150 Lbs Flange, MS Plated
- FA15S4 : 1½" ANSI/ASME B16.5 150 Lbs Flange, SS 304
- FA15S6 : 1½" ANSI/ASME B16.5 150 Lbs Flange, SS 316
- F20MS : 10 mm thick Flange conforming to 2" ANSI/ASME B16.5 Flange, MS Plated
- F20S4 : 10 mm thick Flange conforming to 2" ANSI/ASME B16.5 Flange, SS 304
- F20S6 : 10 mm thick Flange conforming to 2" ANSI/ASME B16.5 Flange, SS 316
- FA20MS : 2" ANSI/ASME B16.5 150 Lbs Flange, MS Plated
- FA20S4 : 2" ANSI/ASME B16.5 150 Lbs Flange, SS 304
- FA20S6 : 2" ANSI/ASME B16.5 150 Lbs Flange, SS 316
- F25MS : 10 mm thick Flange conforming to 2½" ANSI/ASME B16.5 Flange, MS Plated
- F25S4 : 10 mm thick Flange conforming to 2½" ANSI/ASME B16.5 Flange, SS 304
- F25S6 : 10 mm thick Flange conforming to 2½" ANSI/ASME B16.5 Flange, SS 316
- FA25MS : 2½" ANSI/ASME B16.5 150 Lbs Flange, MS Plated
- FA25S4 : 2½" ANSI/ASME B16.5 150 Lbs Flange, SS 304
- FA25S6 : 2½" ANSI/ASME B16.5 150 Lbs Flange, SS 316
- F30MS : 10 mm thick Flange conforming to 3" ANSI/ASME B16.5 Flange, MS Plated
- F30S4 : 10 mm thick Flange conforming to 3" ANSI/ASME B16.5 Flange, SS 304
- F30S6 : 10 mm thick Flange conforming to 3" ANSI/ASME B16.5 Flange, SS 316
- FA30MS : 3" ANSI/ASME B16.5 150 Lbs Flange, MS Plated
- FA30S4 : 3" ANSI/ASME B16.5 150 Lbs Flange, SS 304
- FA30S6 : 3" ANSI/ASME B16.5 150 Lbs Flange, SS 316

Insulation Type

- P : Partly Insulated, PTFE
- F : Fully Insulated, PTFE
- C : Ceramic (35T, REF)

Sense (RDP)

- SS4 : SS 304
- SS6 : SS 316

Rope Weight (ROP)

- RWS6 : SS 316
- RWS4 : SS 304
- RWMS : MS Plated

- **Operating Temperature**
  - 10T : Up to 100℃
  - 25T : Up to 250℃
  - 35T : Up to 350℃ (C)
- **Standoff Material**
  - STGI : GI (Galvanized Iron)
  - STS4 : SS 304
  - STS6 : SS 316
- **Probe Length**
  - 1H30H : 100 to 3000 mm (RDP)
  - 5H200H : 500 to 20000 mm (ROP)

Example - Capvel-I-FP2C-PCN5D-3MAMP-DC4-STWS4-RDP-MB15S4-P-SS4-10T-1H30H

Shows First Priority Entity

- Applicable
- Not Applicable