The SFM TEMPERATURE FLOW PRESSURE HUB (SFM-TFPHUB) collecting water temperature, flow status, and water pressure data used to monitor and manage thermostatic mixing valve (TMV) performance and water quality to eradicate scalding and waterborne pathogen infection risk in premise plumbing.

As part of a Smart Flow system, each hub monitors thermostatic mixing valves (TMV) and other plumbing fixtures (shower, basin, faucet, handwash, …). The temperature sensors, flow switches, and pressure sensors installed in the plumbing system are connected to the SFM TFP HUB which is connected to smart flow system through the industrial in-field communication network with standard RS485 interface.

Typical installation is either as a single or dual installation in a SMARTFLOW HUB BOX (SFM4000-HL), a single hub supports up to 5 total TMV/Fixtures, so a dual installation can support up to 10.

A SFM BACKBONE CONNECTOR (SFM-BACKBONE) connector should be used in each SMART FLOW HUB BOX (SFM4000-HL) to join the daisy chain backbone and allow for connection of up to 2 hubs, this is opposed to the old method of double punching RJ45 connectors.
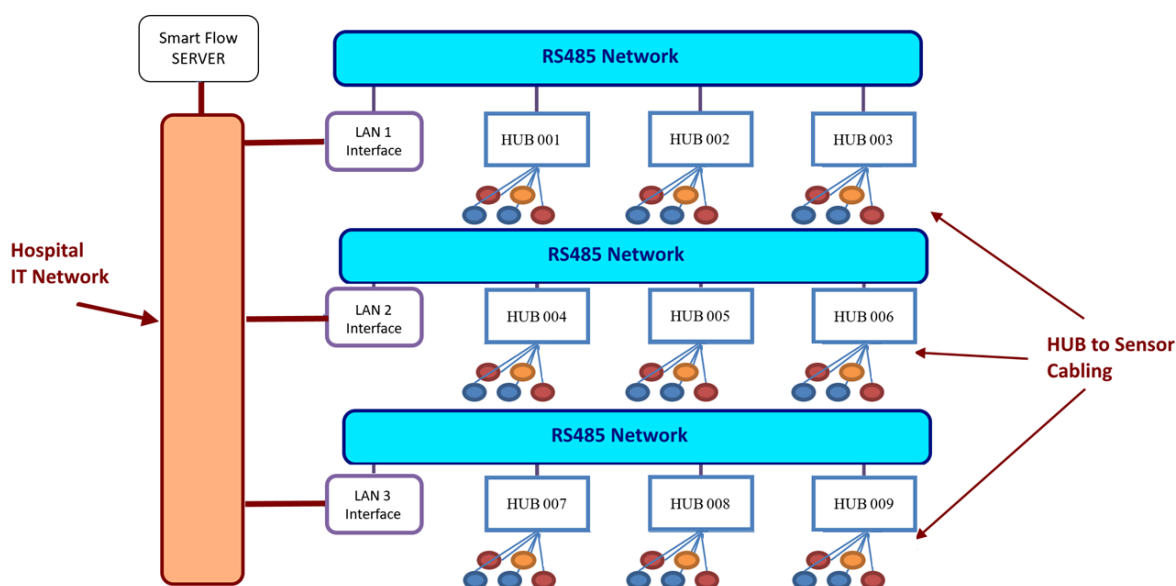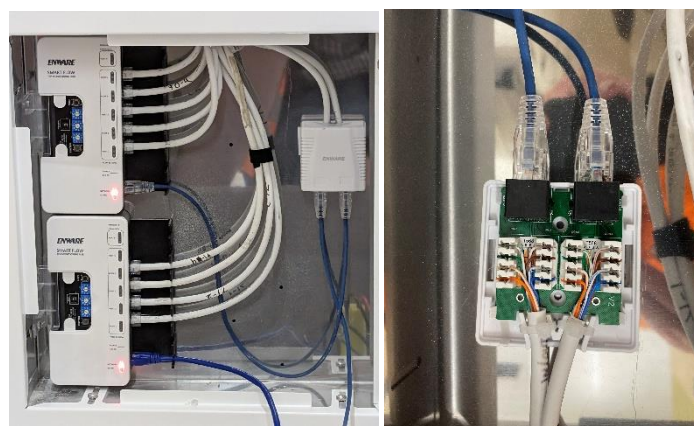
1 Functional Specifications

1.1 Sensor Capacity

- 6 ports
    - o 5 Port monitoring 15 channels.
        - Each port has 3 channels (cold, hot, warm)
        - Each channel can connect one temperature probe and one flow sensor.
    - o 1 port monitors two pressure sensors and has a I2C interface.

1.2 Temperature Sensors

1.2.1 Temperature probe specification

NTC thermistor, 10kΩ, 3892K.

1.3 Flow Sensors

1.3.1 Flow sensor parameters

- Maximum rated voltage: 12V d.c.
- Maximum rated current: 50mA
- Signal type: reed switch
- Flow status and signal frequency

Status	Description
Flow on (turbine)	Signal frequency 1.5-100Hz with pulse >3ms
Flow off (turbine)	Other condition except for Flow on(turbine)
Open/close (flow switch)	Switch status changed and signal frequency <1Hz. Flow status can be derived from switch status based on the flow switch type.

1.4 Pressure Sensors

1.4.1 Pressure parameters

- Pressure range: 0-16bar
- Accuracy: ±2% F.S

1.5 RS485 Communication

1.5.1 Read real-time sensor data

- Read all real-time data including temperatures, flow status/turbine rate, pressure for all channels through RS485 network.

1.5.2 Data Log

The latest hub events are recorded in Hub and accessible when requesting. The operations on hub events are listed as below:

- Temperature (°C)
- Flow (Hz)
- Pressure (kPa)
- Restarted
- Error

1.5.3   Remote management

1.5.3.1   Read Device Information

Below information can be read through RS485 port

- Hardware version
- Firmware version

1.5.3.2   Remote Firmware Update

- Hub firmware can be updated remotely via RS-485 interface.

1.6   Internal RTC

- Accuracy: <1s daily
- The HUB has internal real-time clock.
- Host can read and change the time through serial network.

1.7   I2C Communication

I2C is a reserved interface in the Hub. It is used to connect I2C displayer keypad shield as the human-machine interface if the PCB is as the tester.

1.8   Status LEDs

The blue, red and yellow LEDs below each RJ45 port shows the hub status.

1.9   Buttons

Two buttons are accessible externally. One button is used as reset button; another button is used as function button.

2   Interface Specification

2.1   Interface to Sensors

There are 6 ports. The hardware has capacity of 19 ADC signal inputs,15 switch signal inputs, and one I2C bus interface. 15 ADC signal inputs are used for NTC thermistors. 2 ADC signal inputs are used for the pressure sensors. 15 switch signal inputs are used for flow sensors. I2C bus interface is reserved for future development.

2.1.1   Pin definition for ports

The mapping for connectors, channels, plumbing type, and sensor types can be configured as requires without changing hardware.

- Default port-channel-plumbing-sensor pin mapping

Port No.	Pin No.	Name	Channel No.	Plumbing type	Signal Type	Description
1	1	GND	NA	NA	NA	Signal reference point
1	2	DC+	NA	NA	Power	9~24V supply voltage
1	3	P1C0T	0	Cold water	Temperature	Temperature sensor for cold water (channel 0) in port 1
1	4	P1C0F	0	Cold water	Flow	Flow sensor for cold water (channel 0) in port 1
1	5	P1C1F	1	Hot water	Flow	Flow sensor for hot water (channel 1) in port 1
1	6	P1C1T	1	Hot water	Temperature	Temperature sensor for hot water (channel 1) in port 1
1	7	P1C2F	2	Warm water	Flow	Flow sensor for warm water (channel 2) in port 1
1	8	P1C2T	2	Warm water	Temperature	Temperature sensor for warm water (channel 2) in port 1
2	1	GND	NA	NA	NA	Signal reference point
2	2	DC+	NA	NA	Power	9~24V supply voltage
2	3	P2C0T	0	Cold water	Temperature	Temperature sensor for cold water (channel 0) in port 1
2	4	P2C0F	0	Cold water	Flow	Flow sensor for cold water (channel 0) in port 1
2	5	P2C1F	1	Hot water	Flow	Flow sensor for hot water (channel 1) in port 1
2	6	P2C1T	1	Hot water	Temperature	Temperature sensor for hot water (channel 1) in port 1
2	7	P2C2F	2	Warm water	Flow	Flow sensor for warm water (channel 2) in port 1
2	8	P2C2T	2	Warm water	Temperature	Temperature sensor for warm water (channel 2) in port 1
3	1	GND	NA	NA	NA	Signal reference point
3	2	DC+	NA	NA	Power	9~24V supply voltage
3	3	P3C0T	0	Cold water	Temperature	Temperature sensor for cold water (channel 0) in port 1

Port No.	Pin No.	Name	Channel No.	Plumbing type	Signal Type	Description
3	4	P3C0F	0	Cold water	Flow	Flow sensor for cold water (channel 0) in port 1
3	5	P3C1F	1	Hot water	Flow	Flow sensor for hot water (channel 1) in port 1
3	6	P3C1T	1	Hot water	Temperature	Temperature sensor for hot water (channel 1) in port 1
3	7	P3C2F	2	Warm water	Flow	Flow sensor for warm water (channel 2) in port 1
3	8	P3C2T	2	Warm water	Temperature	Temperature sensor for warm water (channel 2) in port 1
4	1	GND	NA	NA	NA	Signal reference point
4	2	DC+	NA	NA	Power	9~24V supply voltage
4	3	P4C0T	0	Cold water	Temperature	Temperature sensor for cold water (channel 0) in port 1
4	4	P4C0F	0	Cold water	Flow	Flow sensor for cold water (channel 0) in port 1
4	5	P4C1F	1	Hot water	Flow	Flow sensor for hot water (channel 1) in port 1
4	6	P4C1T	1	Hot water	Temperature	Temperature sensor for hot water (channel 1) in port 1
4	7	P4C2F	2	Warm water	Flow	Flow sensor for warm water (channel 2) in port 1
4	8	P4C2T	2	Warm water	Temperature	Temperature sensor for warm water (channel 2) in port 1
5	1	GND	NA	NA	NA	Signal reference point
5	2	DC+	NA	NA	Power	9~24V supply voltage
5	3	P5C0T	0	Cold water	Temperature	Temperature sensor for cold water (channel 0) in port 1
5	4	P5C0F	0	Cold water	Flow	Flow sensor for cold water (channel 0) in port 1
5	5	P5C1F	1	Hot water	Flow	Flow sensor for hot water (channel 1) in port 1
5	6	P5C1T	1	Hot water	Temperature	Temperature sensor for hot water (channel 1) in port 1
5	7	P5C2F	2	Warm water	Flow	Flow sensor for warm water (channel 2) in port 1
5	8	P1C2T	2	Warm water	Temperature	Temperature sensor for warm water (channel 2) in port 1
6	1	GND	NA	NA	NA	Signal reference point
6	2	DC+	NA	NA	Power	9~24V supply voltage
6	3	P6C0P	0	NA	Pressure	Pressure sensor for cold water (channel 0) in port 6
6	4	SDA	NA	NA	I2C	Data for I2C bus
6	5	SCL	NA	NA	I2C	Clock for I2C bus

| Port No.	Pin No.	Name	Channel No.	Plumbing type	Signal Type	Description
6	6	P6C1P	1	NA	Pressure	Pressure sensor for hot water (channel 1) in port 6
6	7	5V	NA	NA	NA	5V for pressure sensors
6	8	GND	NA	NA	NA	Signal reference point

2.2 Interface to RS485 Serial Network

2.2.1 Description

RS485 network interface to upper system (Smart Flow LAN1) through RJ45 connector with power over ethernet capability applying standard IEEE802.3af using data pairs (active PoE).

2.2.2 BCD address for RS485 interface

BCD Address rotary coded switches are used to set the device address for RS485 interface.
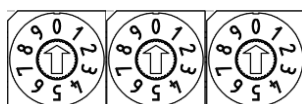
ADDR100   ADDR10   ADDR1

Address = ADDR100x100 + ADDR10x10 + ADDR1

2.2.3 Electrical specification
- Electrical standard: RS485

2.2.4 Serial port configuration
- Baud rate: 57600
- Data bits:8
- Parity: None
- Stop bits: 1
- Flow control: None

2.2.5 Connector specification
- Connector type: Female RJ45 PCB connector
- Pin definition:

Pin No.	Net name	Comments
1	GND	Reference pin
2	DC+	12~24VDC positive
3	GND	Reference pin
4	A	A, which is low for logic 1 and high for logic 0
5	B	B, which is high for logic 1 and low for logic 0
6	GND	Reference pin
7	DC+	12~24VDC positive
8	GND	Reference pin

3 Environmental Specifications

3.1 Ambient Temperature

-5 ~ 50°C

3.2 Ingress Protection

≥IP20: protection against solid objects larger than 12mm (contact from finger).

3.3 ESD Protection Level

AS/NZS 61000.4.2:2002 level 1 human body

4 Mandatory Standards

- AS/NZS 3100:2017 Approval and test specification - General requirements for electrical equipment.
- AS NZS 3820-2009 Essential safety requirements for electrical equipment.
- AS/NZS 61000.4.2:2002 Electromagnetic compatibility (EMC) – testing and measurement techniques – Electrostatic discharge immunity test.
- ASNZS 62368.1:2018 Audio/video, information and communication technology equipment, Part 1: Safety requirements
- CISPR 14-1 Electromagnetic Compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1: Emissions
- AS 60529-2004 Degrees of protection provided by enclosures (IP Code)