



COMBINATION VALVE DECODER & SENDER (V2) Valves, Pressure and Flow

The COMBO or HYBRID decoder combines a valve solenoid on/off control, a pressure sensor input and two alternative flow inputs; one for Woltmann-type contact closure flow meters and the other for pulse-type variable frequency open-collector flow meters.

Housed in a water-tight encapsulated tube, the combination decoder may use any or all the inputs and outputs. A green/red/orange LED makes troubleshooting easier.

It is compatible with Tonick BT2 and Irrinet decoder interfaces. Additionally, the Tonick RM-2 Internet-based controller.

(The BT2 is an OEM product and can be customised to suit the customer's controller. The range includes a full function Eurocard, down to a pre-programmed microprocessor that can be built into the customer's own controller PCB.)

Version 2 now has an alternative protocol.

1-127 valve decoders with sensors at the same address as the valve.



When using MK3 Signalling with Customer Code, using the BT2 or Irrinet decoder interface, the Master Valve address may be allocated with the programmer/tester to anything between 1 and 127

Using the MK3 signalling, the Pressure, Flow Contact Closure or Flow Frequency may be accessed at that address by placing the following command codes in the top byte of the sender address.

Code	
2	Flow Frequency
3	Flow Contact Closure (totalising)
4	Pressure

For example
valve 23 decimal, = 17 hex
Read flow frequency: Send 0x217 to the combo
Read pressure: Send 0x417 to the combo.

If the top byte is zero, the legacy conventional method of accessing the Combo will be used by the BT2/Irrinet decoder interface. This does not use MK3 signalling.

LEGACY SPECIFICATION:

Master Valve:

Conventional on/off AC output for a standard solenoid, or a DIAS in solenoid mode (programmed to address 0)

Responds to address 126 or 127 or 63 or 62 (as programmed on the programmer/tester)

Use with NO or NC master valves as needed.

Pressure:

For use with:

“TransducersDirect” 0-10Bar. G1/4 male thread

“Pentair PT1200” -1Bar to +6Bar. G1/4 male thread

Byte output 0-255

Responds to Sender #9 (with MV programmed to 126/62)

Sender #12 (with MV programmed to 127/63)

Flow Contact Closure:

Standard volt-free contacts (from something like a Woltmann flow meter)

0-5 contact closures/sec. De-bounced

Byte output

Count: 0-127, wrapping around.

128 bit reflects contact position. 1 = contact closed, 0= contact open

Responds to Sender #10 (with MV programmed to 126/62)

Sender #13 (with MV programmed to 127/63)

Flow Frequency:

(Open collector pulses, fed by +9V from decoder)

Example flow-meters:

Creative Sensor Technology FSI-T00-000 0.5-200Hz

George Fisher Signet 2536 0.5-255Hz

Badger Meter

(measurement interval 2 seconds, rounded to 1 byte)

Byte output 0-255 for 0-255Hz

The Combo is calibrated for 50Hz 2Wire path frequency. If used with 60Hz, scale the measured byte reading by 6/5

Responds to Sender #11 (with MV programmed to 126/62)

Sender #14 (with MV programmed to 127/63)

Depending on the type of flow sensor fitted, the relevant sender register must be read.

Sender numbers are automatically allocated depending on whether MV address 126/62 or 127/63 is programmed using the programmer/tester. This allows 2 combo decoders to be used on one 2wire path in legacy mode. HOWEVER, if using the MK3 signalling, up to 127 may be used on the same 2wire path

Wire Colours:

(Type 99 military specification wires)

Wire Path:

Red, Black: 19-32VAC 50/60Hz. Standby current 5mA

Master Valve:

Brown, Violet: 24V AC solenoid output (Brown internally connected to red.) Max 300mA at 24VAC

Pressure:

Orange: transducer power. +4.4VDC, 10mA max

White: Transducer signal 0-2.5V (MUST BE NON RATIOMETRIC)

Blue: Transducer 0V

Flow:

Yellow: +9V transducer power (if needed), max. 15mA

Green: flow pulse or contact closure (internally fed from +9V through 4K7 resistor)

Grey: Flow pulse 0V or contact closure

LED:

bi-colour

Green: Combo listening, has power

Red: Sender being interrogated.

Orange: Valve on.

NOTES:

DIAS-compatible.

In MK3 mode

Can be used with up to 126 other Combos, or

In legacy mode,

Other legacy senders programmed to sender addresses not used by the Combo.

Only the pressure transducers stated are compatible. If a 3rd party sensor is desired, it must have the following characteristics:

- operates from minimum 4.0Vdc, unregulated. Max. consumption 10mA
- produces a non-ratiometric output, max 2.5V, min 0V
- 0V produces a reading of 11, +100mV a reading of 14 +2.5V a reading of 255 , linear between +100mV and 2500mV.

Aquamonix has introduced two pressure-based water level transducers with vented cables. Tank level 0-3m and well level 0-30m. Both will interface to the Combo pressure transducer inputs.

Flow Meter Contact Closure Counter Algorithm

This has software to count de-bounced contact closures into a 7 bit accumulator. The top bit reflects the state of the contact, open or closed. All 8 bits are returned when interrogated.

These may be read through the Blind Translator2 (BT2), Fn. 0x06, or via 2 Holding Registers in the ModBus RTU version of the BT2 or Irrinet.

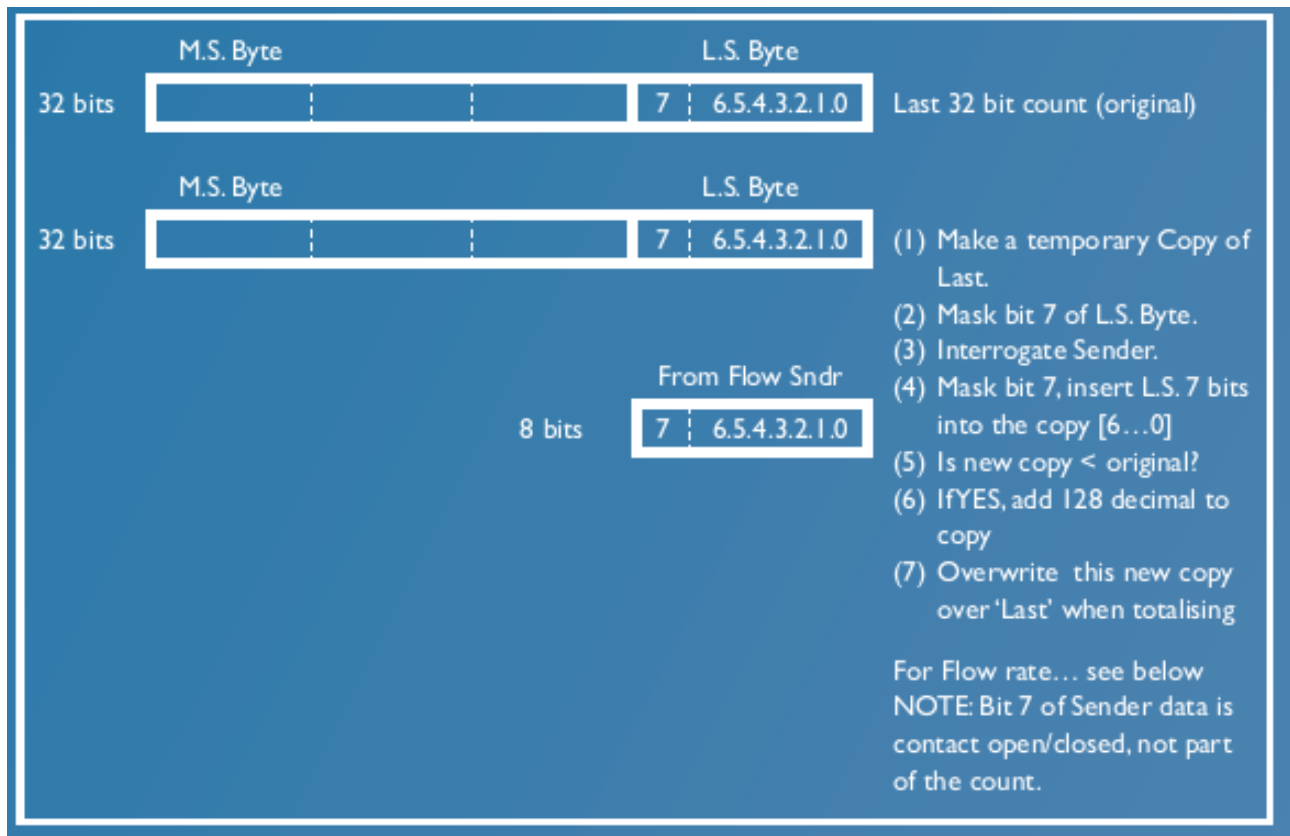
The accumulator will wrap around from 0x7F to 0x00 when overflowing. If the Host controller's software measures the difference between two successive readings and using its measure of time elapsed, it can then calculate the flow rate. The latency between asking the BT2 to return a reading and getting it, will be 2 +/- 0.5 seconds.

No further decoder or sensor commands must be sent until the reply has returned.

The top bit of the accumulator will reflect the open/closed status of the switch. 1 = closed, 0 = open. This may be used to detect switch status rather than flow pulses.

Totalising Flow

To accommodate the wrap around from 0x7F to 0x00, the following algorithm may be used.



Measure Flow Rate:

The difference between 'new copy' and 'Last' is the number of contact closures recorded. Multiply this by the Volume constant for the flow meter and divide by the time interval between measurements to get the flow rate. The latency of 2 +/-0.5 seconds in the reply will be approximately the same for each reading, so can be ignored when computing the time interval between readings.

The contact closure sensing is limited to maximum 5 per second. Contact is de-bounced for 10mS max., which will accommodate most type of relay outputs from a flow meter.

Be careful to read the accumulated counts regularly enough so that there can only be one wrap-around between readings.

e.g.

5 Hz, every 25 seconds max.

3 Hz, every 42 seconds max.

1 Hz, every 2 minutes max.

0.1 Hz (1 closure per 10 seconds), every 21 minutes max.

etc.

Measure Rainfall

Contact closures from a tipping bucket rain gauge may be accumulated instead of from a flow meter.

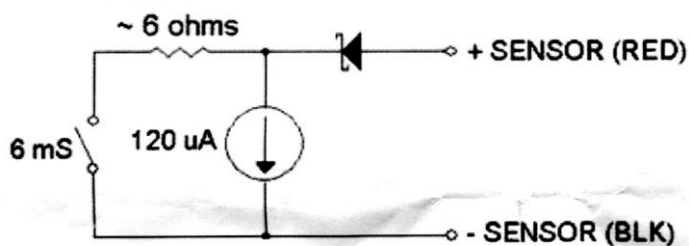
Flow Meter, Frequency Measurement

A flow frequency transducer may be used instead of a contact closure. Normally this is a 2-wire device, where the positive wire is connected to the Combo green wire and the negative wire to the Combo grey.

When not pulsing, the transducer internal circuit takes a small current from the positive. This is supplied by the Combo from the green wire fed from +9V through its internal 4K7 resistor.

When a flow pulse is generated, an open collector circuit pulls the positive and negative close together for about 5mS. At higher frequencies, this becomes approximately a square wave.

The figure below is a simplified circuit diagram of the internals of a flow transducer.



Frequencies range from about 0.1Hz, up to about 250Hz depending on the make of the flow transducer and the velocity of the water flowing in the pipe.

The frequency can be converted to flow, by manufacturer's supplied constants, K and Offset, which depend on the pipe diameter and desired units of flow.

$$\text{FLOW} = (\text{Frequency} + \text{OFFSET}) * K$$

The combo returns frequency in a byte 0-255 corresponding to 0Hz-255Hz. Measurement interval is 2 seconds, then rounded to cycles per second (Hz) and packed into the byte.

There is a tolerance of +/- 1Hz on the returned reading. There is a smoothing algorithm with about 15-20 seconds settling.

The flow frequency returned is scaled for 50Hz 2wire path frequency. If the Combo is used on a 60Hz 2Wire path frequency, scale the byte reading by 6/5

Tonick and Aquamonix have introduced two additional sender decoders

- 4-20mA output sensors, with optional +19V power feed if needed.
- SDI-12 V1.3 compatible sensors.

These may be mixed with the Combo or other legacy sender decoders.



Part Number: TK-COMBO

Tonick Watering & Underhill Europe
Sales Office
Wilsonwells Croft
Crimond
Fraserburgh
Aberdeenshire AB43 8YH
UK (+44)
tel: (0)1346 531193
Mail:sales@tonick.co.uk Web:www.tonick.co.uk

Specifications subject to change without notice

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