The NEXT GENERATION Irrigation Decoder Family.
TW/NG

Drawing on 29 years' experience in the design of irrigation decoder systems, 2Wire Innovations now offers a new family with unique features to make your irrigation control system stand out.

- New 2-wire signalling method. Resistant to AC power distortion and noise.
- Automatic site mapping system with decoder geolocation and notes collected**
- Lower power; many stations active at the same time over long distances.
- No DC anywhere, earth leakage tolerated.
- Outstanding lightning protection, including a replacement warranty.
- Decoder programmed and tested using a free App in an ordinary Android Phone.
- Protection against tampering, whilst still permitting diagnostics
- Decoder can hold its geo-location and installer's notes
- Entire site layout and station's/zones notes can be read by the RTU and will be made available to the central control
- Directions, using his personal phone, to guide an engineer to a particular valve box.**
- Compatible with the new generation of valves that have flowing status sensor

** The method of inserting data into the decoder using NFC, the gathering of that site's data by the decoder interface and the promulgation of the information into a service technician's phone, is covered by international Patents.

There are currently 6versions of the decoder.

1. **TW/NG-1**

Single output decoder. Address range 1-255. Standby current 1.2mA. Built-in lightning protection; no need for grounding down the 2-wire path, just one at the controller.
NFC communications:
As well as setting the decoder address, its geo-location and 2 lines of free text can be added, using an App on an Android phone. Security features are available to prevent unauthorised tampering. Decoder functionality, 2-wire AC input voltage and valve on/off operation can be tested using NFC. Acknowledgment of successful on/off commands reported back down the 2-wire path to the interface.

2. **TW/NG-1-CC**

All the features if the TW/NG-1, plus the ability to sense contact closures from an external switch. The cumulative total of closures and/or the current switch state can be interrogated through the 2wire path.
Applications: Flow meters. Combined valve on/off control and water used. Correct operation of a valve by sensing control chamber diaphragm's position.

3. **TW/NG-1-420**

All the features of the TW/NG-1, plus the ability to measure 4-20mA from sensors. 24VDC loop excitation output from the decoder. Variable sensor warm-up dwell can be achieved with cooperation from the controller.
Applications: Pressure; lake or well level; 4-20mA flow meters; soil moisture; crop biometrics.

4. TW/NG-1-2.5

All the features of the TW/NG-1, plus the ability to measure 0-2.5V from sensors. 5VDC sensor power excitation output from the decoder. Variable sensor warm-up dwell can be achieved with cooperation from the controller.

Applications: Pressure; lake or well level; 0-2.5V o/p flow meters; soil moisture; crop biometrics.

5. TW/NG-1-AC

All the features of the TW/NG-1 plus the ability to operate conventional 24VAC irrigation solenoids. Lowers 24VAC solenoid holding current from 250mA down to 50mA. Detects shorted and open solenoids

Applications: Use to operate popular valves from Rain Bird, Hunter, TORO etc, without the need to replace the valve's solenoid with an eCOIL

6. TW/NG-1-HZ.

All the features of the TW/NG-1, plus the ability to measure the frequency of pulses from an insertion flowmeter. Measures 1-250Hz, low-going pulses from a flowmeter with 2 wires. 24VDC sensor excitation.

Figure 1 TW/NG-1-CC Version

Accessories for sensor decoders which must also operate a valve

(**Note**: The TW/NG-1-AC decoder will drive standard 24VAC solenoids from most manufactures, without the need of these accessories)

Low Current Solenoid, eCOIL

Figure 2 eCOIL, low current solenoid

A standard-sized solenoid that only consumes 35mA operating, when powered by normal 2-wire AC voltages.

- No exposed DC voltages preventing electrolytic damage to cables.
- Lightning protected.
- Versions threaded to fit popular valves from Hunter, Rain Bird and Toro.
- A 3-way version, with back water port, is also available for larger valves.
- eCOIL can be separated from the TW/NG series decoders by up to 300m, without degradation of lightning immunity in either.

Applications:

- Where larger numbers of stations/zones are needed to be active at the same time.
- Significantly longer 2wire path distances are achievable.
- Replacement of satellite pedestal systems feeding Valve-in-Head sprinklers.
- Can be used with conventional multi-wire irrigation controllers

Motorised Pilot Valve

A motorised pilot can be fitted to valves and has many advantages compared to a standard 24VAC solenoid.

Figure 3 Valve with motorised pilot fitted

- 18VAC-40VAC operating voltage
- Similar cost to a 24VAC solenoid
- Manual knob for open/close/auto
- Less than 10mA "holding" current
- IP68 Water protection
- TW/NG-1 family tolerates 5 second open and close delay
- Made in the EU

Applications:

- Where larger numbers of stations/zones are needed to be active at the same time.
- Significantly longer 2wire path distances are achievable.

Irrigation Decoder Interfaces:

Signalling down the 2-wire path has been simplified compared to most other methods. Only a few relatively low cost and compact components are needed. The new method achieves greater immunity to distortion and noise. Lightning damage immunity is not compromised.

A range of interfaces are available:

For the existing irrigation controller manufacturer.

1. A kit of custom components, to allow a new version of its family of controllers to take advantage of the decoder/eCOIL features. (full engineering support given)

2. A PCB assembly, engineered to the dimensions needed by the manufacturer, so it can be incorporated into its existing modular controller. A variety of communication interfaces are available. E.g. I2C, SPI. Serial RS232, RS485, ModBus RTU.

For the users of PLC and other control systems.

Users of wastewater treatment and pumping control systems that would like to add irrigation or water dispersal capabilities.

3. **DG-3 (Decoder Gateway 3).** DIN-rail mounted interface in a plastic enclosure

- Back compatible with the Tonick BT2 family and DG-2
- Modbus RTU interface
- Up to 127 stations/zones on one 2-wire path
- Up to 16concurrently operating stations/zones (with eCOIL or TW/NG-1-AC decoders)
- Distances up to 5Km
- Detection of duplicated decoder numbers
- A tally published of discovered decoders
- Reporting of on/off water flow through a valve
- Background retrieval of decoder stored parameters
- Valve Status Reporting
- LAN interface to permit Over-The-Air (OTA) firmware upgrade.

Figure 4 Can be fitted with a custom label

DG-3. AUTOMATIC DATA COLLECTION:

(This polling goes on in the background, but only now and again, so as not to clog commands for valve on/off or sensor decoder interrogation).

Detection of duplicated decoder numbers:
DELTAI in 40-026 holds the number of mA increase due to the reply from a successful decoder switch. This is typically +250 to +290 mA. If a decoder number is duplicated, both will respond to the same 'on' command and both will produce a reply at the same time, so DELTAI will be approximately double. This is a reliable marker of double numbering.

Setting 40-003 "Current change threshold upper (mA)" to less than double the reply value will generate a fail but leave the DELTAI value to be inspected by the host controller.

A tally of discovered decoders:
DISCOVERED, 40-029 to 40-036, holds a tally of decoders discovered during successful on/off or from a background check, using talkback command 7 to see if there is any reply. (Result in same format as in ACTUAL array, 1 bit per decoder)

Discovery of fitted decoders is initiated when the 2wire line is first powered up. When all 127 decoder stations have been interrogated this will be suspended. The operation takes approximately 7 minutes to complete all 127 possible decoder, however normal valve on/off and sender interrogation using Modbus commands can commence immediately.

Background retrieval of decoder stored parameters.
When commanded, the DG-3 inches through the fitted decoders, asking for all 35 parameters from each, then storing them into an EEPROM page. This is normally done at commissioning time. If all 127 decoders have been fitted, this will take about 21 hours.

Information can be collected from just one individual decoder using a different command instead.

When collection is completed, if subsequently asked through Modbus to publish the INFORMATION inside a decoder, the DG-3 instantly retrieves all 35 parameters that were stored in EEPROM and places them into the INFORMATION holding register array 40-038 to 40-072, ready for Modbus reading by the host.

Valve Status Reporting:
A new generation of valves is now being produced. A mechanism to detect the position of the diaphragm in the valve's control chamber is fitted. One version provides a volt-free reed switch which will close when the diaphragm is fully flexed, meaning the valve is completely open and passing water under pressure. Another version has a low cost pressure switch on the valve's output. Using this feature, successful water flow in on/off valves can be determined *without the use of expensive flow meters*.

The decoder TW/NG-1-CC has an extra pair of wires (coloured black) to connect to this reed or pressure switch, When commanded by the DG3, the contact state will be returned. 1 = valve fully

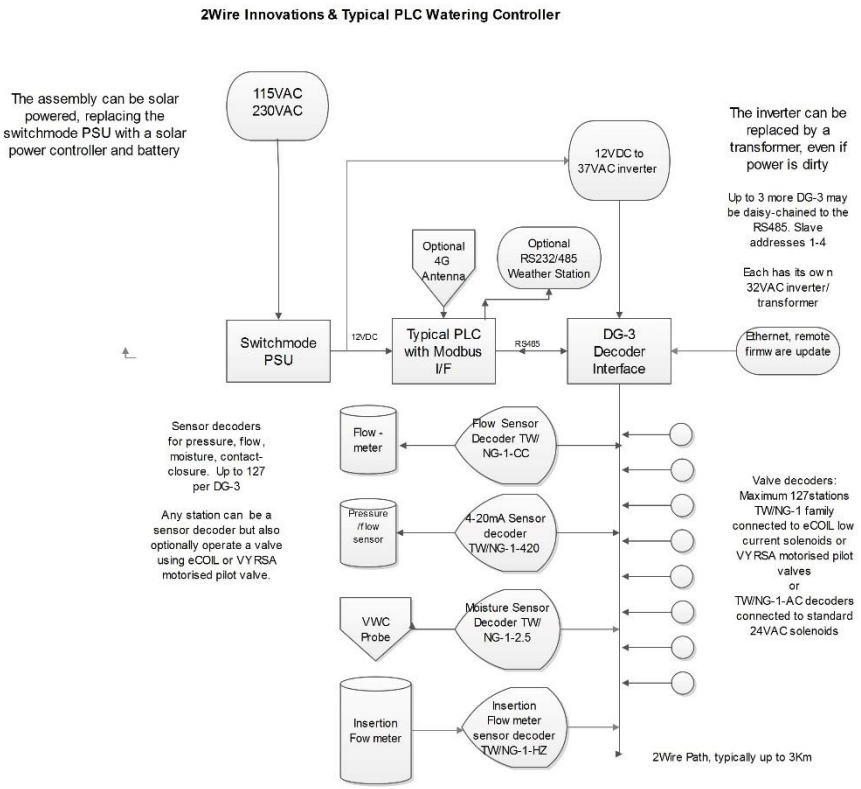
open, 0 = valve closed. This is reported in the DG3 using the ModBus function, 'Read Holding Registers'. If the valve is fully open, the register data bit in the 'FLOWING' array will be 1.

Please note this 'FLOWING' data bit is separate from the data bit in the ACTUAL holding register bank. This latter indicates whether the solenoid on/off state attached to the decoder matches that which is in the same bit in the DESIRED holding register bank. The ACTUAL bit value is available about one second after commanding the valve to change state.

As valves take time to open and close, the 'FLOWING' data will not reflect the diaphragm position for several seconds, sometimes tens of seconds, depending on the valve's design. Thus, the time elapsed before the ModBus interrogation of the coil must be defined in the RTU host controller that operates the interface.

When enabled, the DG3 will cyclically interrogate all valves that are currently commanded on, taking about 3 seconds per valve. This will be published in the holding register bank (named FLOWING) and read using ModBus function 03.

Typical PLC Adaptation to Irrigation Control



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