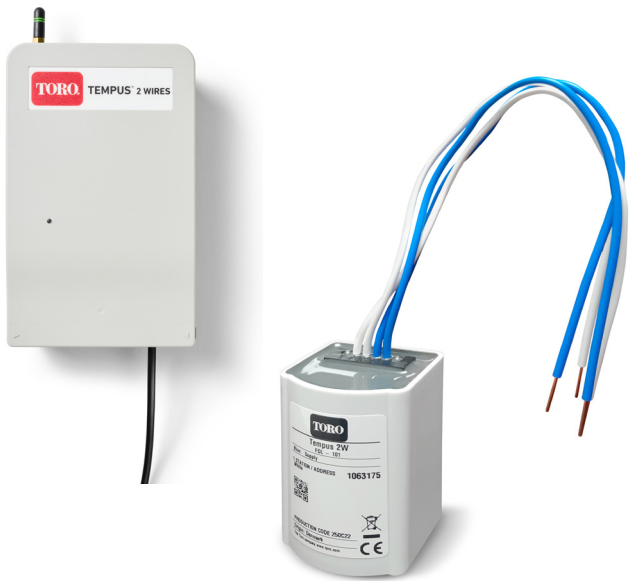
DECODER SYSTEM

User's Guide



INTRODUCTION

This guideline serves to guide you to make a good and sustainable installation which will last for years and protect your investment.

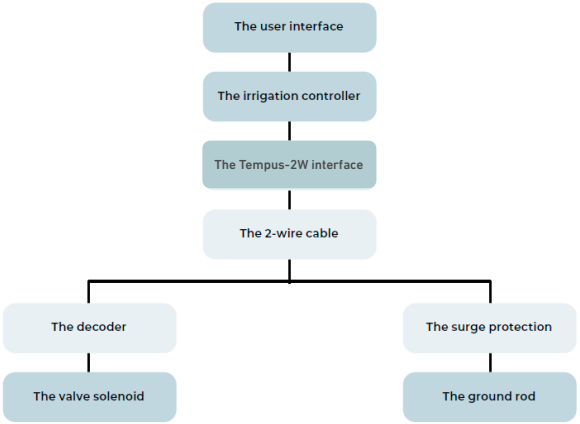
This guideline gives you information about:

1. The system components/main elements such as the interface, decoders and cables
2. The structure of the field installation, layout etc.
3. Wire requirements
4. Surge protection requirements
5. Assembly requirements
6. Integrity check
7. Wire interface Installation

1. THE SYSTEM COMPONENTS

The decoder system consists of various components described below.

The main elements in an irrigation system are:
The guideline does not cover the valve installation nor the controller part, but all the parts from the 2-wire interface to the solenoid driving the valve.



The TEMPUS-2W interface

The interface serves as the link between your irrigation controller and the 2-wire system. The interface receives commands from the controller and transform them into 2-wire commands which the field components understand and react upon.The result of these commands will be sent back to the controller. These commands can be activation of a solenoid.

The interface works with a low voltage on the 2-wire; i.e. no need for certified electricians to install the system.

The 2 -wire cable

In a 2-wire decoder system the 2-wire cable serves both as power source and communication path for the field decoders.
The 2-wire cable installation makes the entire system installation much easier and neater. Just pull a 2-wire cable from the interface and install decoders along the wire where needed.

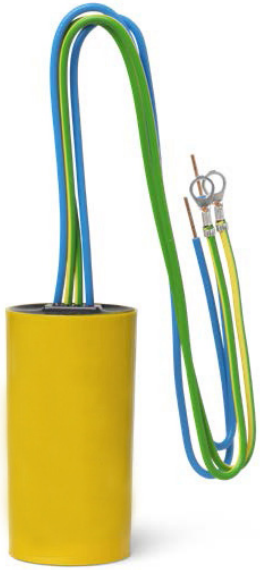
Note: *There is no required polarization of the conductors in the 2-wire.*
Observing the polarity is only required when using the loop configuration.

The decoder

The decoder is the device which drives the solenoid. Please see the data sheets for the various decoders. The decoder has an address which is used by the interface to communicate with the decoder.
The address must be known by the controller.

The surge protection decoder

The surge protection decoder is used to protect the installation in case of lightning strikes.
For more information read section 4.



Various other components

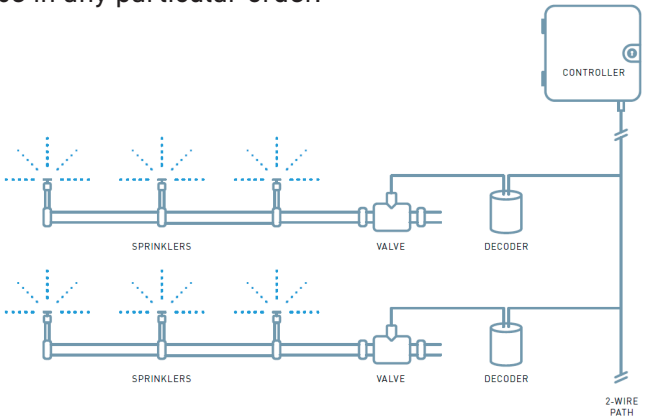
To complement the elements above you will need grounding rods and splice kits.

2. THE STRUCTURE OF THE FIELD INSTALLATION

The layout and installation of a 2-wire system is simple, but certain rules must be obeyed.

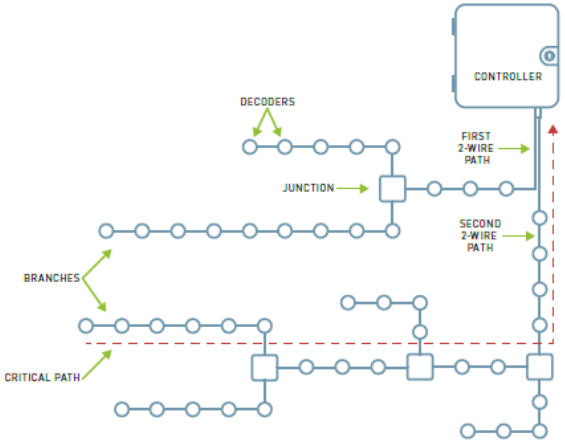
Principle of installation of 2-wire, decoders and valves

The figure shows the principle of the interface, 2-wire, decoder and valve connection.
The decoders can be installed anywhere on the 2-wire. They all have a unique address and they don't have to be in any particular order.



Star configuration

The figure shows a typical star installation. The interface has multiple 2-wire terminal sets and it is recommended to pull more 2-wires from the interface to the field. This serves an easier troubleshooting for e.g. shorts as the wires can be tested one at the time.
It is important to be aware of the critical path which is the cable distance to the farthest end. This may never exceed the specification for the cable used, see below.



Loop configuration

The figure shows a typical loop installation. The interface has multiple 2-wire terminal sets, but it is recommended to loop the wire back to the same terminal set especially if more loops are used. It is important to use color coded wire and make sure all splices along the wires are kept the same; i.e. black to black, red to red.

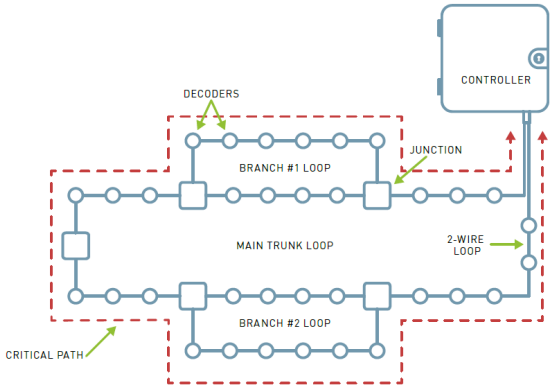
In case of troubleshooting e.g. short on the 2-wire it is important to open the loop either at the interface or somewhere along the 2-wire.

It is important to be aware of the critical path which is the cable length of the entire loop. This may never exceed the specification for the cable used, see below.

In general, it is recommended to use star over loop for easier installation and troubleshooting.

Branches

The 2-wire can be branched off at any place and in as many places as desired. Be aware that it may change the critical path. On a star configuration it might just be the new farthest point, but on ,a loop configuration with a branch which loops back at another point it might prolong the total cable length. If it is branched off on a loop configuration, but not looped back, then the branch shall be treated as a star in respect to the critical path.



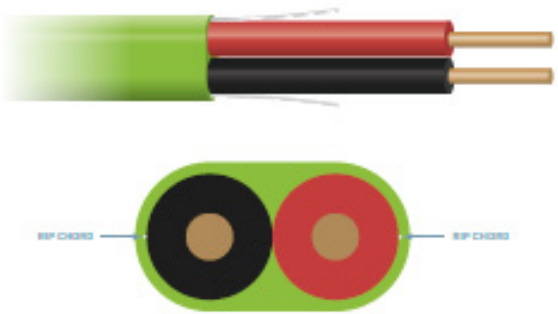
3. WIRE REQUIREMENTS

Wire specification and quality

The 2-wire cable shall be jacketed solid parallel wires for direct burial. It is recommended to use e.g. Paige P7072D.

Specification of the Paige cable can be found:
http://paigewire.com/products aspx?cat=3&specid= 75#

Similar, but twisted wires can be used.



Wire length of the 2-wire

The wire length depends on the diameter of the wire.
The following tables show 2-wire wire length for a system with up to 48 decoders per 2-wire path, with 4 decoders active, and with the decoders evenly distributed.

MAXIMUM LENGHT OF CRITICAL WIRE PATH - METRIC WIRE SIZE

Nominal wire size	Loop		Star	
	KM	Miles	KM	Miles
2.0 mm^2	9.6	6.0	2.4	1.5
2.5 mm^2	16	10	4.0	2.5

Wire length of the solenoid wire

The wire length depends on the diameter of the wire.
In general, it is recommended to have as short solenoid wire as possible to limit lightning strikes.

MAXIMUM LENGTH FROM DECODER TO SOLENOID

Nominal wire size	Meters	Feet
1.5 mm^2	100	328
2.0 mm^2	133	436
2.5 mm^2	166	545
16 AWG	88	289
14 AWG	139	456
12 AWG	220	720

4. SURGE PROTECTION REQUIREMENTS

Grounding of the system is important to protect the installation against lightning surge.
A lightning surge may damage the system if it is not properly protected. A lightning surge can be induced anywhere in the system. The lightning will be induced in both wires as a common surge.
The induced surge will traverse along the wires until it can pass on to the ground.

The interface

The interface must be grounded with a ground rod or ground plate connected via a 14AWG / 2.5mm^2 wire. The resistance to the ground must be 10 Ω or less. Eventually place more ground rods n a Y configuration welded together to establish the desired resistance. It is also recommended to establish the grounding in an area which has a high soil moisture. It could even be in an area regularly irrigated by the system to keep a good connection to the soil.

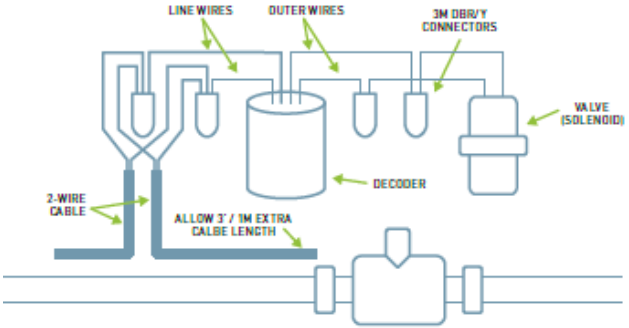
The field installation

The field installation must be grounded to protect against lightning surge. The installation must be grounded via special surge protection decoders (see below).
The surge protection decoders must be placed along the wires for every 150 m / 500' plus at the end of each branch. The surge protection decoder must be grounded via a ground rod of 50 Ω or less. It is important not to deviate from the specified cable type above and use single wires. This can be tempting in a retrofit installation, but the two wires will most likely not run in parallel. Thus, a lightning surge will be induced as a differential surge. This is harmful to the decoders.

5. ASSEMBLY REQUIREMENTS

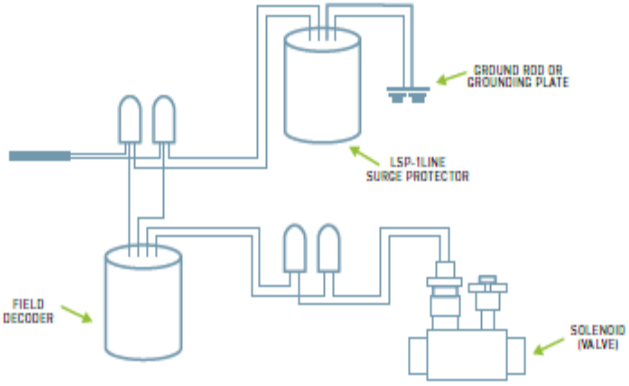
Decoder installation

It is recommended to install the decoders as shown. Leave about 1 m / 3' 2-wire cable to allow future work or troubleshooting on the installation. Leave 30 cm / 1' of 2-wire wires without the outer jack to allow using a clamp meter for troubleshooting.
Ensure watertight connections on both the 2-wire connections and the solenoid connections.



Surge protection decoder

The surge protection decoder must be installed as mentioned above in the chapter about surge protection in the field. Both the green/yellow wires shall be connected to the ground rod/plate.



Connectors

An important factor to ensure a long-lasting system is to make ALL connections are watertight – not only the 2-wire connections, but also the solenoid connections. This also counts for sensor decoders and surge protection decoders.
It is recommended to use 3M DBR/Y-6 or similar.
Do not reuse the gel caps after dismantling as for parts the silicone will be removed when pulling the cables out.

Valve boxes

Even though the decoders are designed for direct burial, it is recommended to install the decoders in valve boxes. It makes future troubleshooting much easier

6. INTEGRITY CHECK

It is recommended to perform an integrity check of the installation to establish a benchmark for future troubleshooting. All you need to perform an integrity check is a leakage clamp meter.

The clamp meter shown below is just an example. It is important it is able to measure in mA resolution. Some clamp meters are also able to measure resistance of a ground rod/plate.

To perform the integrity check you need to set the system in short finding mode (50/60 Hz).

Note the current draw of each branch of the 2-wire. Check the actual current draw against the expected draw, which can be calculated from the number of decoders on the branch and their type.
The following table shows the expected standby current draw of the various decoder types. The expected current draw is +/- 10%.

EXPECTED STAND-BY CURRENT DRAW BY DECODER TYPE

Decoder	Expected current (mA)
1 address, 1 solenoid per output	0.2
Surge protection	0

7. WI-FI 2-WIRE INSTALLATION

INSTALLATION

A. Specification

Input	100-240VAC, 50/60Hz, 400mA@230VAC, 800mA@115VAC
Output	36VAC, 280mA
Storage	-40°C to +80°C, 10% to 95% RH. Do not store at extremes for extended periods of time.
Operating	-20°C to +60°C. 20% to 90% RH, non-condensing. Do not operate in direct sunlight.
IP Rating	IP54, i.e., protected against dust and splashing water.

B. Mounting

To be mounted indoor or outdoor on a vertical wall. Do not place or operate in direct sunlight. Mount near mains outlet or source a cable of suitable length using IEC320-C7 connector (not included).

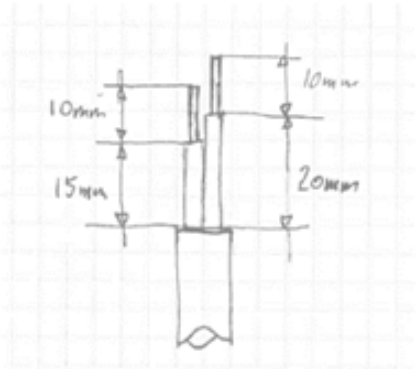
Suitable mounting hardware (not included) 3 x 4-5mm flat head wood screws with head size 6-9mm. The length should be adequate for the surface plus 8mm. On mineral surface use plugs and screws of suitable length. A mounting template is found on the reverse side.
Provided antenna must be mounted. Do not replace.

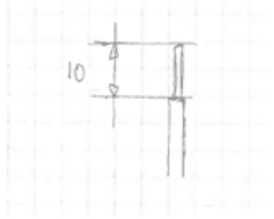
C. Wires

For the 2-wire preferably use solid conductor cable of minimum cross section:
- For 1000 m cable use minimum 0,75 mm2 (AWG 18)
- For 2000 m cable use minimum 1,50 mm2 (AWG 15)
- For 3000 m cable use minimum 2,00 mm2(AWG 14)
- For 4000 m cable use minimum 2,50 mm2 (AWG 13)

Prepare wire as shown to the right. Connect to terminals A & B by inserting wires under the plastic bracket and PCB. Use a PZ2 screwdriver to fasten.

For the functional ground use a short wire of largest practical cross section to ground. This protects the device from electrical surges resulting from e.g., lightning. It is not a safety ground! Prepare as shown to the right. Use a PZ2 screwdriver to fasten.





Place the strain reliefs over the wires and secure using the included screws and a TX10 screwdriver.

D. Setting a WIFI access point

Upon first startup the SSID of a WIFI access point must be specified.
From a WIFI enabled device, connect to the 50-WIFI interface SSID using password specified on the product. You may optionally scan the QR code with a suitable reader App.
Depending on your device and device settings you are either,
a) shown the product web page. Simply start usage.
b) asked to 'sign in to network'. Press OK to show the product web page.

c) connected but nothing happens. Start your browser. Go to the IP address 10.10.10.1 to show the product web page.
d) connected to a different access point. If this happens, disable mobile data and automatic connection to other WIFI access points and try again.

Now open the ‘System’/’Wifi’ menu. If no ‘Ssid’ is shown, or you want to change it:
1) press thebutton  to scan for WIFI networks.
2) Press the ‘Accesspoint’ to view a list.
3) Click on your chosen access point..
4) Enter the ‘Password’.
5) Press ‘Connect’.
You will lose your direct connection if the interface changes WIFI channel when connecting to the SSID.

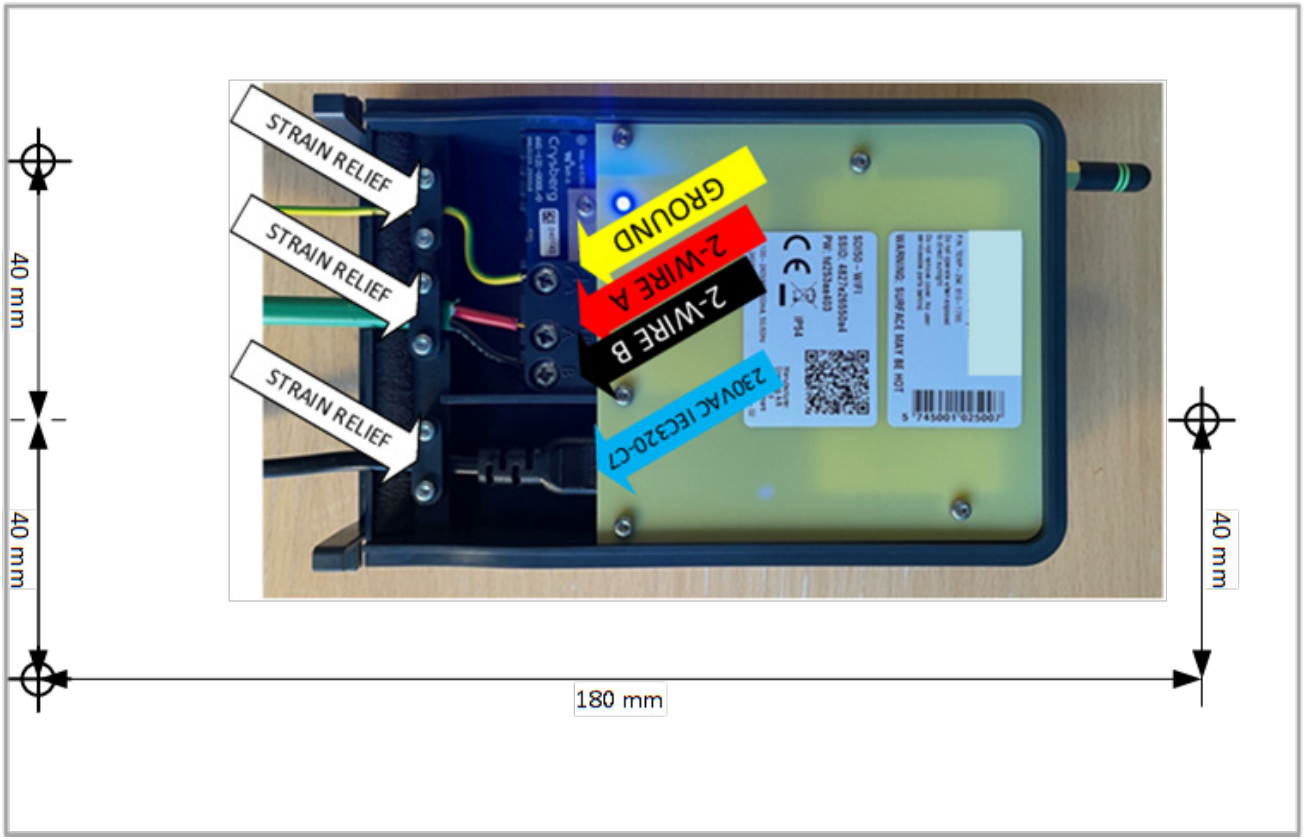
The blue LED is on while trying to connect to an access point. It blinks blue when AP is connected and while connecting to internet and servers.
It then turns green when all connections are established.

E. Mounting template

Template for drilling holes for wall mount.

F. Mounting visualization

Picture of interface with mounted wires, cables and strain reliefs.


STRAIN RELIEF
STRAIN RELIEF
STRAIN RELIEF
GROUND
2-WIRE A
2-WIRE B
230VAC IEC320-C7
40 mm
40 mm
40 mm
180 mm

NOTE

For Technical Assistance:

www.toro.com/

TORO®