Gallagher

Z20 Disturbance Sensor

Installation Note

Gallagher Z20 Disturbance Sensor: G12915 / G12917



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ATTENTION: This equipment contains components that can be damaged by electrostatic discharge. Ensure both you and the equipment are earthed before beginning any servicing.

1 Introduction

The Z20 Disturbance Sensor is an intelligent intrusion detection device that senses the kinematic behaviour of structures. The sensor measures the kinetic energy of a structure and signals an alarm when the energy levels on the structure exceed pre- determined threshold levels.

Prior to installation, each sensor must be pre-programmed with a unique address using either a Z20 Programmer (A10) (Preferred) or a C10 Controller, use of a C10 Controller requires a standard PC running a terminal program, such as HyperTerminal or Tera Term.

When installed, the sensors are connected to the Gallagher Controller 6000. The Controller 6000 is equipped with two RS485 ports, each port is capable of connecting up to 32 sensors, allowing a maximum of 64 sensors to be monitored from a single Controller 6000. It is recommended that you do not exceed 31 sensors and that sensor address No1 is always left unassigned to enable additional features within Command Centre.

The RS485 ports on the Controller 6000 must be configured to use the "Sensor bus" device communications protocol. This communication protocol supports the use of Z20 Disturbance Sensors only.

Once connected to a Controller 6000, the parameters for each sensor can be configured individually in Gallagher Command Centre. Command Centre allows for sensor diagnostic information reporting, and alarm management.

Command Centre v8.10.xx or higher, features the ability to re address a sensor from the default address (1), provides “live sensor view” for easy configuring and also logging & reporting capability within Command Centre.

Sensors now come supplied with a "choke" board. The choke board has been designed and tested to reduce interference that can be induced on the connecting cables from various RF sources. It has been designed to make installation and maintenance easier and more reliable resulting in less false alarms and improved reliability. To maximise their usefulness the connection needs to be as close to the sensor as possible.

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2 Installation Design

2.1 Program Communication Address

Prior to installation, each sensor must be programmed with a unique address using either a Z20 Programmer (A10) or a C10 Controller.

- If using a C10 Controller, a standard PC running a terminal program, such as HyperTerminal or Tera Term will be needed. Refer to the *"Controller C10 User Manual (3E2349)"* for details. This document can be viewed and downloaded from the following link: https://media.gallagher.com/asset/f19ec7e0-378b-4578-91bf-d3cdabd6837e/3E2349-Controller-C10-User-Manual.pdf
- No PC or additional software is required when using the Z20 programmer (A10).

Hint: Clearly label the sensor with the address you have programmed, (e.g. use a permanent marker) on the rear side of the sensor.

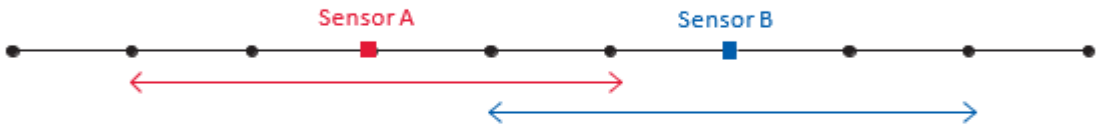
2.2 Redundancy

You will need to ensure that redundancy is designed into the system to prevent potential dead spots and minimize the impact of a damaged or failed sensor. This may mean adjusting the alarm thresholds and other settings or spacing the sensors at more frequent intervals.

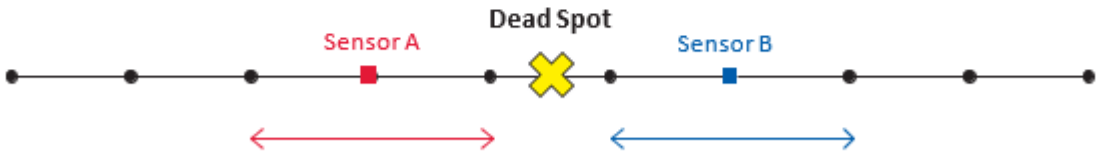
The first example below shows 100% redundancy, (i.e. two sensors cover the same area - hence both sensors will register the attack at the same time).



100% redundancy
The dynamic threshold value is at a level that ensures coverage of the perimeter by at least 2 sensors



50% redundancy
The dynamic threshold value is at a level that ensures coverage of the perimeter by at least 1 sensor



0% redundancy (dead spot)
The dynamic threshold value is at a level that does not ensure coverage of the perimeter

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2.3 Using the Voltage Drop Calculator

The maximum number of sensors on a single RS485 data cable is determined by:

- the Controller 6000 device limit (32 sensors per RS485 port, recommended not to exceed 31 sensors),
- the distance between the Controller and the last sensor on the cable,
- the resistance rating of the cable, and
- the voltage drop on the cable (maximum accumulated drop is 3 Vdc).

A voltage drop calculator has been created to facilitate the calculations. It is called *"Z20 Disturbance Sensor Calculator V4.1.xlsm"* and can be used to determine if a network design falls within the acceptable parameters. This file can be downloaded from the following link: https://media.gallagher.com/asset/3d45241a-0321-4c8e-80b6-03812c0fea5d/Z20-Calculator.xlsm

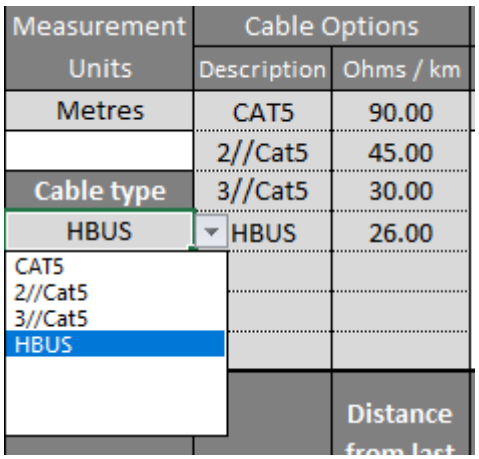
The following topics describe how to use the calculator.

2.3.1 Specify the Cable Type

The resistance (in Ohms per kilometre) of the Gallagher approved Cabling is specified in the section **Cable Options**. The **Cable type** drop-down list is used to change the multiple of cores. The cable type and No of cores will affect the voltage drop calculation. It is recommended that external HBUS cable (C303901) be used in most installations.

It is important that only external rated cable is used in the installation of Z20 Disturbance Sensors, use of other cables can result in a loss of performance.

Select the **Cable type** you wish to experiment with from the drop-down list.



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2.3.2 Specify the Number of Sensors at each Location

In the **Quantity** column enter the number of sensors at that location (usuallythis will be 1 sensor per location).

Sensor(s)	Quantity	Distance from last sensor(s) (m)
1	1	15
2	1	6
3	1	6
4	1	6
5	1	6
6	1	6

2.3.3 Specify the Distance Between Sensor Locations

This is the distance from the previous sensor location to the current sensor location. The first entry will be the total length of cable between the Controller and the first sensor and should include all elevation changes in the cable route between sensors. The unit of measure can be selected as either meters or feet. These distances need to be include the height of the cable up the fence from the location of the cable run to the sensor position e.g. if the sensors cable is running along the bottom of the fence line (in conduit) and the sensors are 1.2m high on the fence, an additional 2.4m of cable will be required between sensors.

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2.3.4 Error Flags (Coloured Orange)

The accumulated voltage drop is found in the cell beside the last sensor. If this accumulated voltage reaches or exceeds 3 Vdc, the system will highlight the error (Orange). An installation must not exceed a total voltage drop of 3 Vdc. This is irrespective of the supply voltage because of the voltage drop influence on the common range of RS485.

This error is resolved by either reducing the number of sensors on the run, distance between sensors or using cable with a lower resistance. If using Cat5E cabling increasing the number of cores to supply power and ground to the network results in a reduction in resistance allowing for greater distances / number of sensors to be used.

Note: If using Multiple core of CAT5 cable care must be taken to ensure quality of joints and connection between cores.

Also, if the number of sensors exceed the maximum of 32, the system will highlight the error.

Quantity	Distance from last sensor(s) (m)	Incremental current (mA)	Incremental voltage drop (v)
1	15	304	0.82
1	6	294.5	1.14
1	6	285	1.45
1	6	275.5	1.74
1	6	266	2.03
1	6	256.5	2.31
1	6	247	2.58
1	6	237.5	2.83
1	6	228	3.08
1	6	218.5	3.31
1	6	209	3.54

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2.3.5 Command Centre Settings

The following table displays the settings that can be configured in Command Centre for each sensor.

Setting	Description
Tilt Threshold	This number determines the rate that the device can be tilted, (i.e. its orientation changed) before it generates an alarm event.
Dynamic Threshold	This number determines the degree of disturbance energy the device can sense before it registers a dynamic disturbance.
Dynamic Count Threshold	This is the number of recurring disturbances that are treated as a single alarm event if they occur within a preset period (Dynamic Hold Time).
Dynamic Hold Time	This is the period within which recurring disturbances (as set by the Dynamic Count Threshold) are treated as a single alarm event.
Dynamic Memory Length	This value indicates how long the device will remember a dynamic disturbance. **Note:** The Dynamic Memory Length must be equal to or greater than the Dynamic Hold Time, multiplied by the Dynamic Count Threshold.
Maximum Event Count	This is the maximum number of dynamic events that can be stored.
Alarm Latch Duration	The duration for which an alarm condition is maintained after the Dynamic Event Count drops to below the Dynamic Count Threshold.

2.4 Z20 Programmer (A10)

The Z20 Programmer (A10) operates independently of PC and Command Centre and is primarily used for addressing a single sensor, it can also be used to check current device settings (address) and reassign a different address to a sensor.

2.4.1 Z20 Sensor Set up

- Plug in the Z20 programmer (A10) into a suitable power source
- Plug in Sensor to be addressed (A10 Device Port)
- Press any key to activate the Z20 Programmer (A10)
- Press 2 – Devices
- Press 1 – D series Devices
- Press 3 – Registers
- Press 3 – Change Address
- Check current address is displayed (by default this should be 001)
- Press + or - to adjust the new address to the required number (002-032)
- Press set, current address and new address should be displayed as same number
- If both addresses are the same select Exit and then remove the sensor.

Note: It may require pressing “Set” again to get address loaded as the sensor may not take new address first time due to data polling time.

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2.5 Attack Response Testing

All sensors should be verified to ensure they provide an appropriate response to an attack. Simulated attacks should be performed to achieve this.

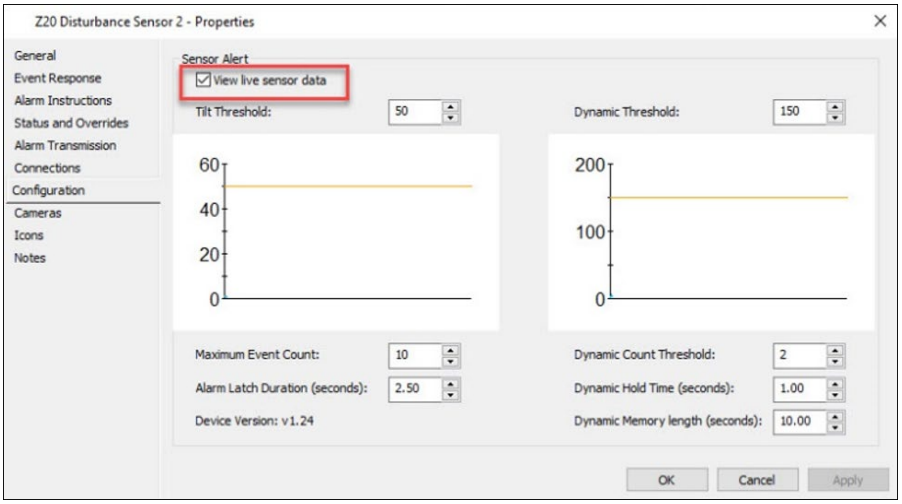
The attacks should not be exaggerated (nor underestimated). The attacks should be an accurate representation of the attack you want to detect. Shaking, climbing, cutting, and moving the structure, and/or running an object down the fence-line is often an acceptable attack scenario that can be used to verify alarms. Adjustments to the settings of the sensors may be necessary. A period of logging selected sensors is recommended to minimize false and nuisance alarms.

2.5.1 Command Centre - Sensor Live View

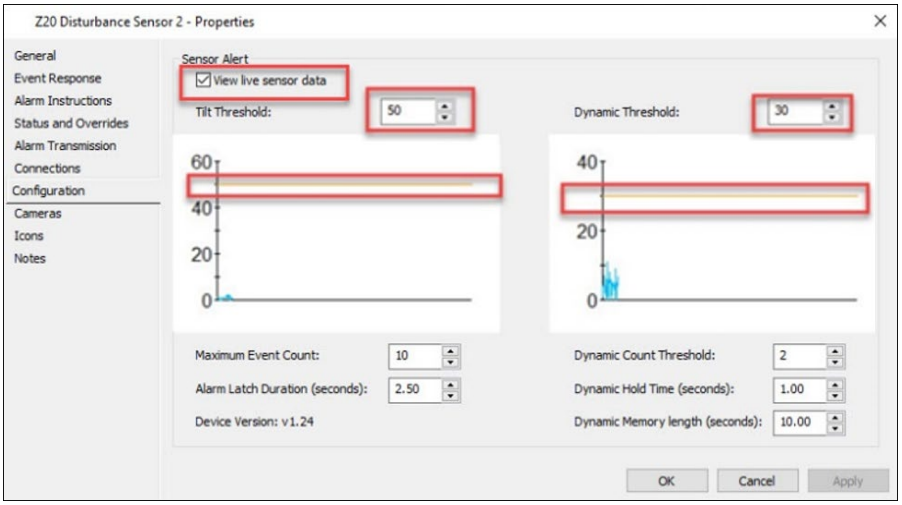
In Command Centre v8.10 (and higher) a live view of sensor data is available on the sensor configurations page in configuration client. Live view provides a real time graph over a short period of time to enable a visual indicator of the data from the sensor in relation to the configured threshold.

To view live sensor data:

1. Open the properties page of the sensor.
2. Open the **Configuration** tab, and tick "View Live sensor data".



3. Adjust the tilt and dynamic thresholds as required, live data will now be displayed on the on-screen displays.



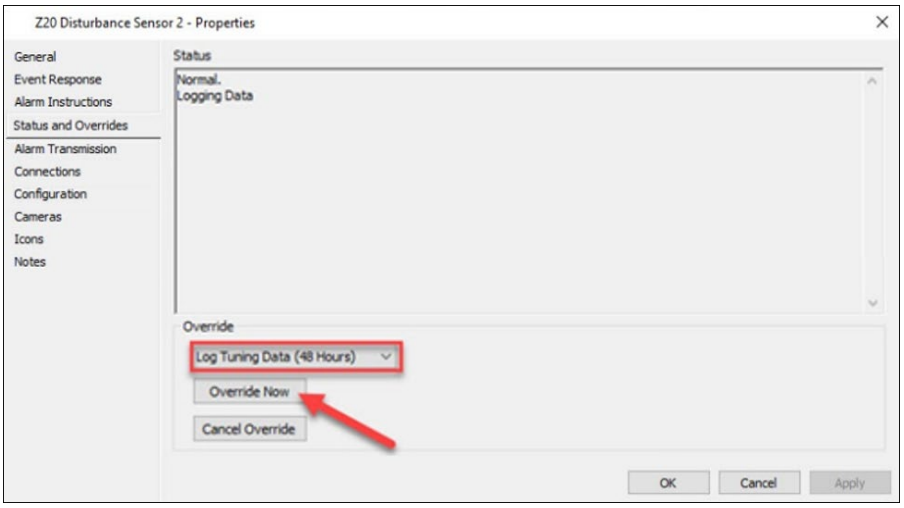
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2.5.2 Command Centre Sensor Logging

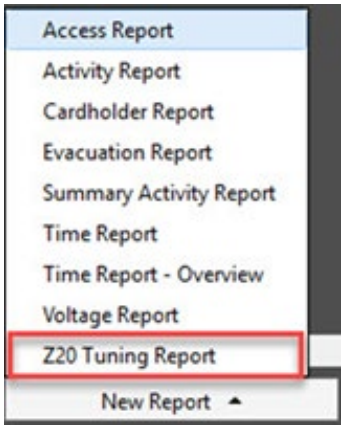
Command Centre v8.10 (and higher) includes an override to record/log sensor data over an extended period of time (up to 48 hours). This data can then be viewed as a Command Centre report or exported to a CSV file for further analysis.

To record/log sensor data for reporting:

1. To view a data report, go to the **Status and Override** tab, select log tuning data (48 Hours) then override now.



2. In Command Centre operational client, go to the **Reports** tab and from the pop-up menu select "Z20 Tuning Report".



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3 Installation

3.1 Equipment Required

There are 2 variants of the Z20 available which contain different mounting clamps, one for use without conduit, one for use with conduit.

For installation without conduit use Z20 Disturbance Sensor (G12915), and ensure the it contains the following items:

- 1 x Z20 Disturbance Sensor with a 300 mm (1 ft) cable tail and fitted RJ-12 (6P6C) connector
- 1 x Z20 Mounting Clamp
- 2 x Tek screws Steel Class

For installation with conduit use Z20 Disturbance Sensor (G12917), and ensure the it contains the following items:

- 1 x Z20 Disturbance Sensor with a 300 mm (1 ft) cable tail and fitted RJ-12 (6P6C) connector
- 1 x Z20 Conduit Clamp
- 2 x Tek screws Steel Class

3.1.1 Tools

Installation tools required are:

- Drill and drill bits
- Socket wrench and (5/16") hex driver (for Tekscrews)
- UTP/CAT5 sheath removal tool (G20210)
- Small flat blade screwdriver for connector
- Electricians pliers
- Wire cutter
- Wire stripper

3.1.2 Components

Components that are required to complete the installation are:

- Z20 Programmer (A10) (G12812)
- Gallagher Controller 6000 (C300100 or C300101)
- Choke board (G12919)
- Wire splice external shells (G10520)
- Cable ties (G10806)

3.1.3 Cable

Cable required to complete the installation is:

- Gallagher External HBUS Cable (C303901)

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3.1.4 Power Supply

Power supply required for the installation is:

- Gallagher Power Supply (C200440)

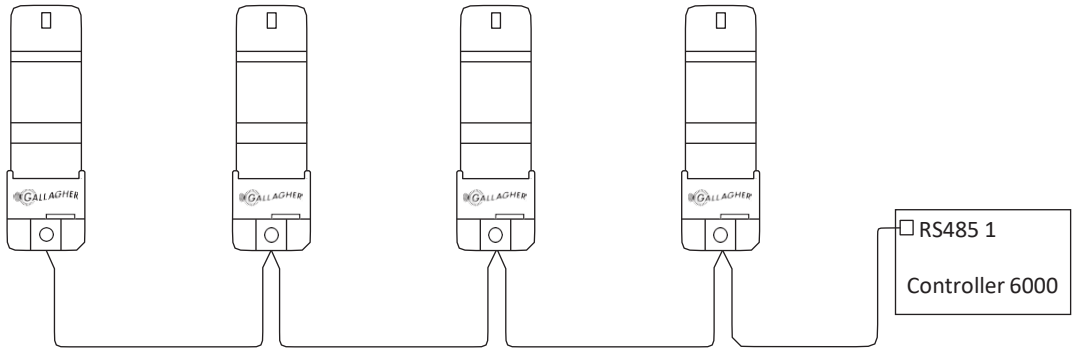
  Ensure the string of sensors are powered through the Controller 6000 not external power source.

Note: It is recommended that a battery backup is also included with the power supply unit. Refer to the Gallagher Power Supply installation note (3E0714).

3.2 Network Configuration

3.2.1 Topology

The sensor network is a daisy chain (multi-drop) RS485 connection. In this scenario, the devices are distributed in a line where the device network enters and leaves each device up to the last device in the line. Refer to the topic *"Connecting the Sensors"* later in this installation note, for details regarding sensor connections.

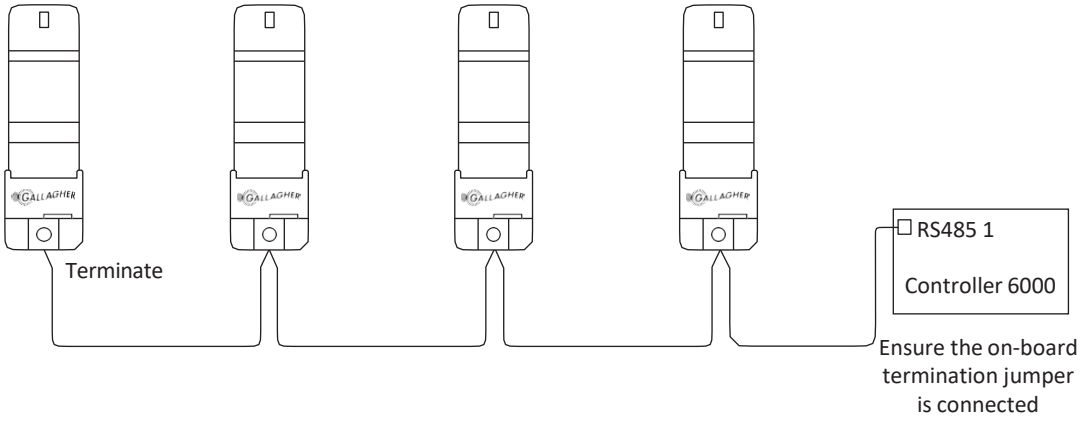


3.3 Termination

The end devices on the RS485 circuit must be terminated using 120ohm resistance.

To terminate the Gallagher Controller 6000, leave the on-board termination jumper connected.

To terminate a Z20 Disturbance Sensor, connect a 120ohm terminating resistor between the Data B and Data A signal wires. This can be achieved by locating the resistor within the clamshell wire-splice connection system (G10520).



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3.3.1 Sensor Connections

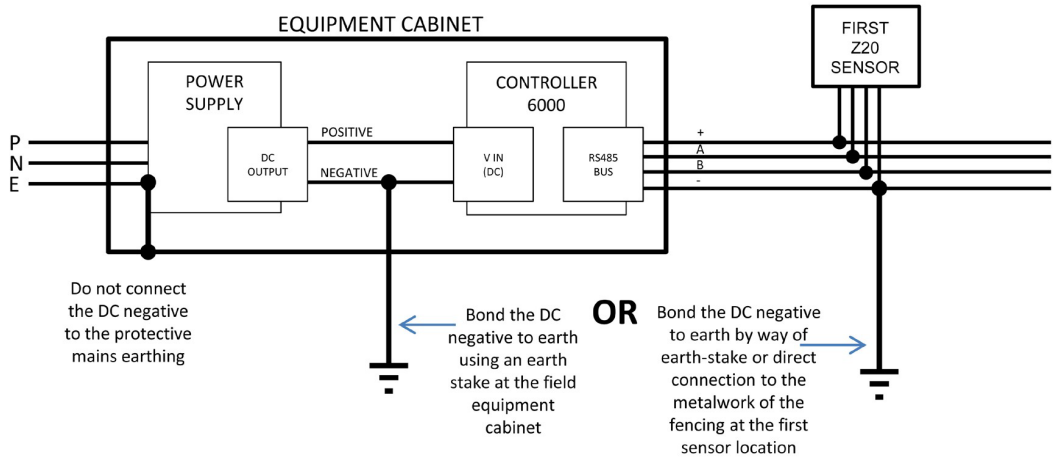
The RJ-12 (6P6C) connector on the Z20 Disturbance Sensor uses pins 1, 2, 5 and 6.

3.3.2 Earthing

The Z20 Disturbance Sensor network requires a specific configuration of earthing. The following needs to be bonded to a shared earthing point:

- The DC Negative of the Sensor Network (-Ve)
- Field Earth Stakes
- Fencing Metalwork

The DC negative of the power supply for the system must be bonded to the General Earth. This is achieved by installing Earthing Stake(s) or creating a connection to the metalwork of the fencing structure. The Earthing Stake(s) should be installed as close to the power supply as possible, (i.e. at the Equipment Cabinet); if this is not possible install it at the first sensor location. The effective earth resistivity of the stake (or fence metalwork) must be less than 10 ohms.



For installations that incorporate earth matting systems, (e.g. Electrical Switch Yard, Distribution Yard) a separate earth pin is not permitted and therefore only a connection to the fencing metalwork can be facilitated.

3.4 Mount the Sensors

3.4.1 Fence mounting

Ensure the sensor is firmly secured to the fence structure. The sensor and mounting clamp must be firmly mounted using the screws supplied (G12914) or replacement screws of material and size to suit the application.

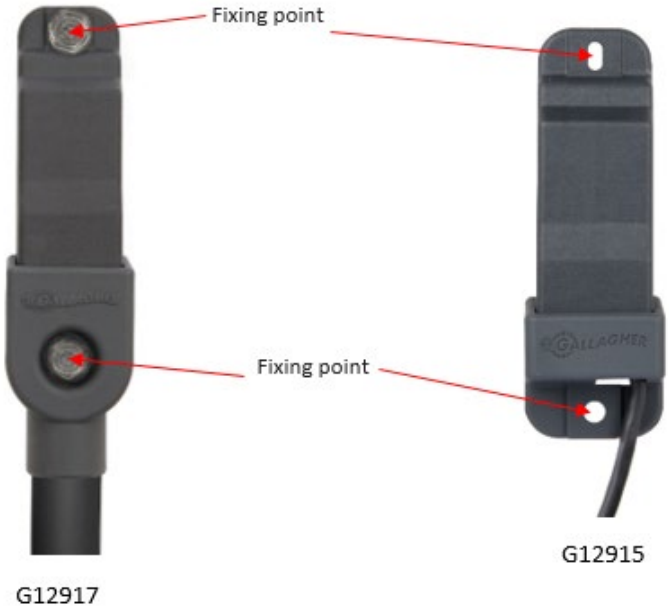
Important: Do not use an adhesive as it may dampen the event signals.

1. Slide the Z20 Cable through the hole in the bottom of the mounting clamp (G12914) or Conduit Clamp (G12916).

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2. Slide the Z20 Disturbance Sensor into the mounting clamp, so that it sits firmly within the clamp.
3. Mount the Z20 Disturbance Sensor assembly to the required structure. Refer to the appropriate topic below. Use the 2 fixing points (one on the sensor and the other on the mounting clamp) and the Tek screws provided to secure the sensor to the structure.



3.4.2 Mounting to a Chain Mesh Fence Post

If the chain mesh fence is in good condition, mounting the sensor to the fence post is the recommended installation method. To actively detect an attack on the fence by an intruder pushing against the structure, mount the sensor on the side of the fence post around mid-height. The sensor can be screwed to the post. Ensure the sensor is firmly secured to provide a good mechanical connection.



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3.4.3 Mounting to a Rigid Structure

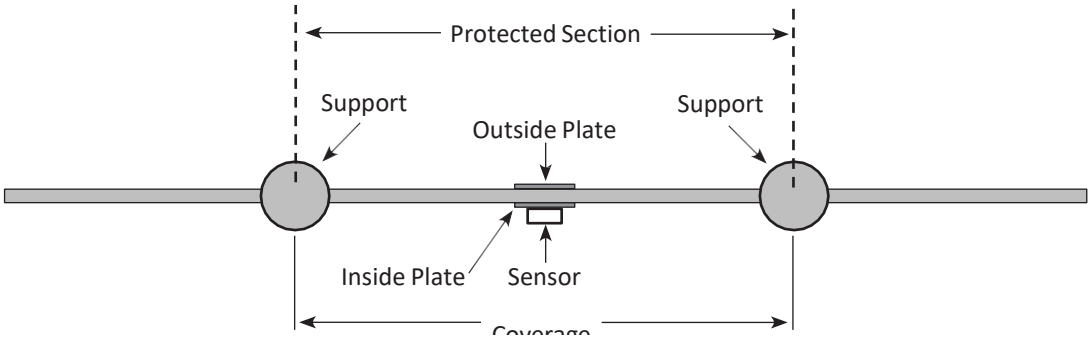
The sensor can be bolted directly to a solid structure, (i.e. prefab wall, sheet metal, masonry, etc.). Remove any plastic coating or insulation between the sensor and the structure that may dampen the event signals. It is recommended a trial period be used to optimize the location of the sensor to maximize the sensor response based on the type of attack that should create an alarm condition.

3.4.4 Mounting to the Mesh of a Chain Mesh Fence

The chain mesh fabric is required to be checked and tightened if necessary. Eliminate any source of vibration, squeaking, tapping, etc. (especially near gates). Mechanical noises generated by the fence structure will generate nuisance alarms.

On chain mesh, the typical installation is mid height (near the tension wire) and beside a line post (~50 to 100 mm). Two custom plates are required. These are normally simple galvanized steel plates. The sensor is mounted to the fence using a coach bolt, through the sensor mount holes, through the inside plate, through the mesh and through the outside plate. Nylock nuts should be used to minimize risk of loosening and also inhibit tampering of the mounting.
Notes:

- The sensor should not be mounted on plastic coated chain mesh, as the plastic coating will have a dampening effect on the vibrations from an attack on the fence, resulting in loss of detection capability.
- Mounting the sensor directly to the mesh like this will render the TILT alarm detection practically useless as the sensor cannot detect angular variation in this plane.



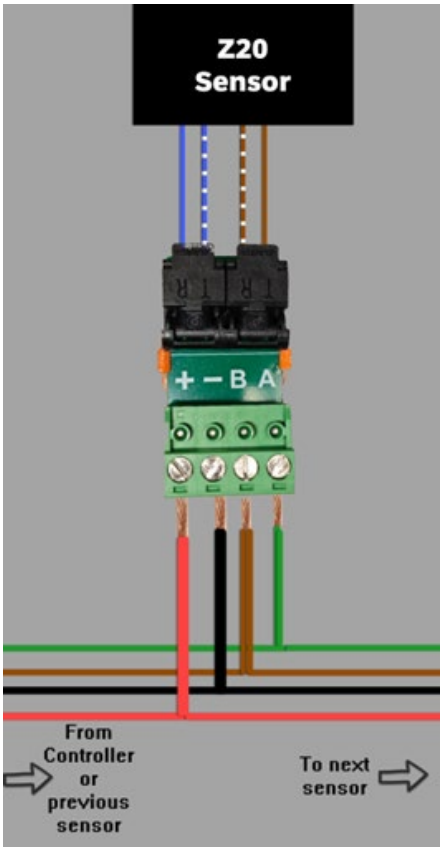
3.5 Connecting the Sensors

Perform the following procedure to connect the Z20 Disturbance Sensors to the Gallagher approved cabling:

1. Cut off the RJ-12 (6P6C) connector fitted to the sensor. Cutting the RJ-12 connector off close to the sensor is best practice. For the choke board to be most effective it needs to be installed as close to the sensor as possible.
2. Strip the end of the outer sheathing (jacket) from the Sensor Cable and the Gallagher approved cable.
3. Insert the cores from the sensor into the black lever lock connector on the choke. Do not remove the wire insulation prior to fitting as the lever lock connector punches through the insulation reducing the chance of damaging the solid core.

   See diagam next for wire identification.
4. Twist the matching cores of the HBUS cable together and insert into the green phoenix connector following the marking on the choke board for +, -, A and B.

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3.5.1 Cable Connections

Sensor Cable	HBUS Cable A	HBUS Cable B
Blue	Red	Red
Blue / White	Black	Black
Brown	Green	Green
Brown / White	Brown	Brown
Green	Not Used	Not Used
Green / White		
Orange		
Orange / White		

3.5.2 Using Conduit

If your installation requires the additional security of conduit, then careful consideration must be given to environmental protection.

Considerations are:

- The junction point of the sensor cabling must be housed in an enclosure that protects from water, dust, insects and vermin, an IP67 enclosure is recommended.
- The conduit system must be installed in accordance with the manufacturer's guidelines to ensure environmental protection of the cabling, (e.g. gluing of conduit fittings, flexible fittings when structural movement is likely, appropriate attachment method to the structure, etc.).
- Where cabling is required to exit the conduit system, the exit point must utilize an environmentally appropriate cable gland, (e.g. nylon compression gland IP68).

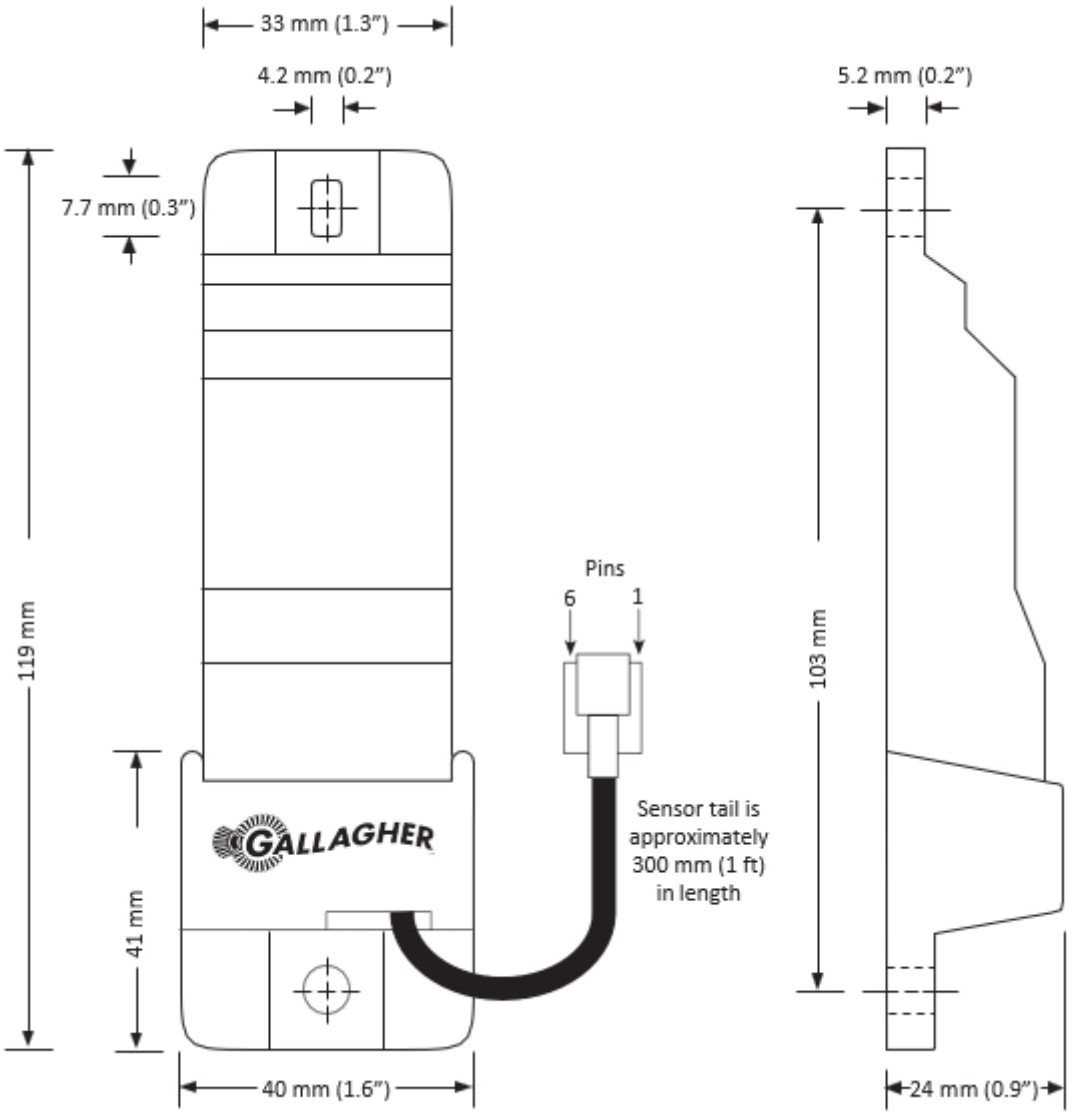
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4 Technical Specifications

Z20 Disturbance Sensor	
Voltage:	10 - 24 Vdc
Current:	9.5 mA
Operating temperature:	-20 °C to +70 °C (-4 °F to +158 °F)
Humidity:	5% to 90% (non-condensing)
Maximum number of units per RS485 BUS:	32
Z20 Disturbance Sensor dimensions:	Height 98 mm (3 55/64") Width 33 mm (1 19/64") Depth 21 mm (53/64")
Z20 Mounting Clamp (G12914) dimensions:	Height 25 mm (1") Width 38 mm (1 1/2") Depth 45 mm (1 3/4")
Z20 Conduit Clamp (G12916) dimensions:	Height 70 mm (2 3/4") Width 38 mm (1 1/2") Depth 25 mm (1")
Assembled: Sensor and Mounting clamp (G12915) dimensions:	Height 119 mm (4 11/16") Width 40 mm (1 9/16") Depth 25 mm (1")
Assembled: Sensor and Conduit clamp (G12917) dimensions:	Height 139 mm (5 33/64") Width 40 mm (1 9/16") Depth 25 mm (1")

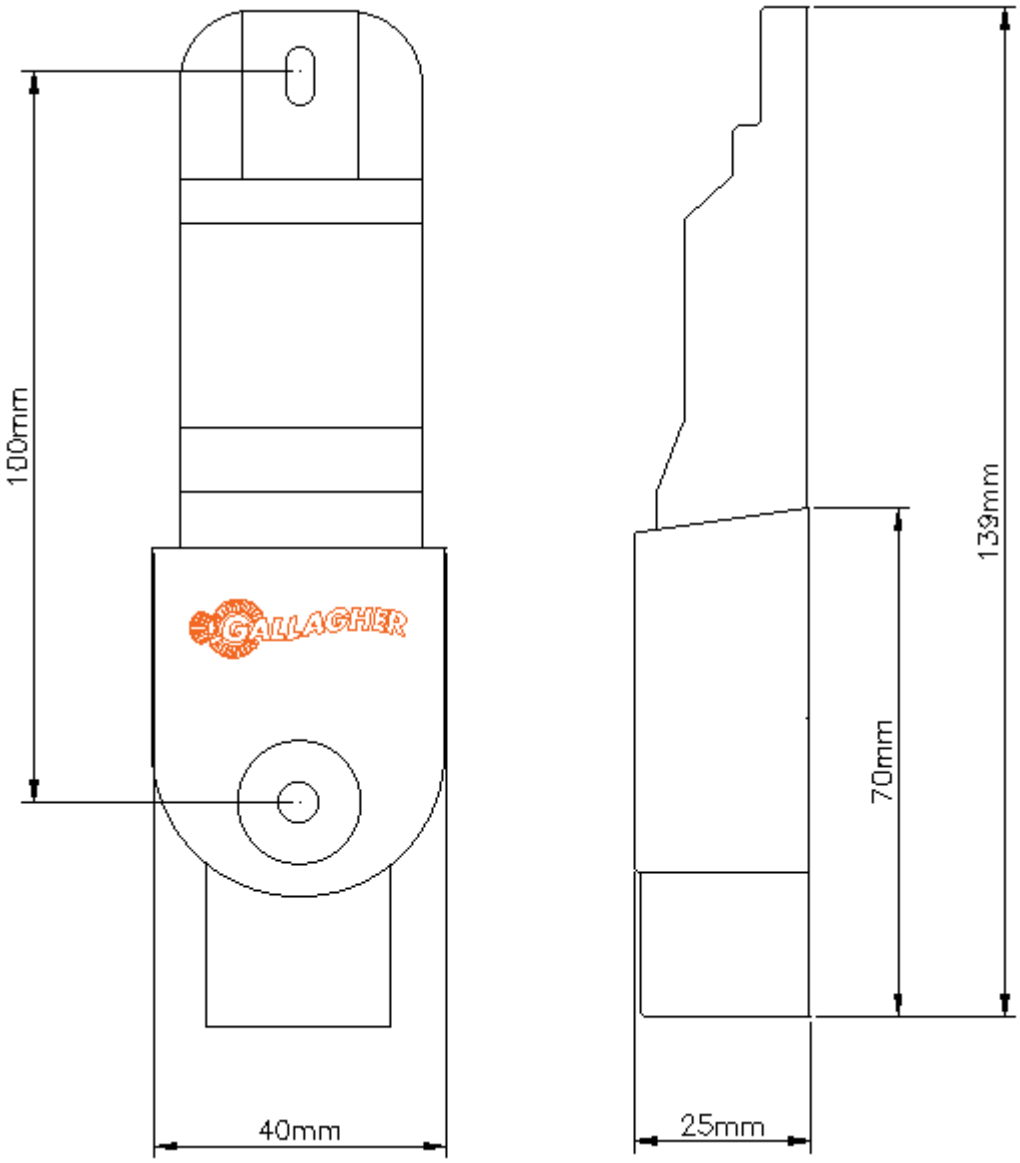
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5 Z20 & Mounting Clamp Unit Dimensions



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6 Z20 & Conduit Clamp Unit Dimensions



IMPORTANT

This picture is not to scale, therefore use the measurements provided.

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