2-WIRE SYSTEMS

2-Wire Gas Detection System Installers Guide V4.56
2-WIRE GAS DETECTION

- 2-Wire Addressable
- APP Based Setup and Service Tools
- 2 Core Cable Connects Detector Nodes
- No Specific Cable Type
- No Cable Polarity
- 350 Detector Nodes/Devices Possible
- Communicate over 3000M Possible
- Cascade Hubs or Control Panels
- Modbus and Bacnet Compatible
- Battery Backup
- BlueTooth
- Ethernet
- USB

Safety Assured

www.internationalgasdetectors.com
This installers guide is intended for the use of system specifiers, surveyors, designers and installers. The intention of this guide is to provide information for the correct installation of IGD’s range of 2-Wire gas detection systems. This guide indicates correct cabling practice, types of cabling which can be used and options available to correctly design and install a 2-wire gas detection system. This guide is not intended as a design or specification guide, these are available separately.

Note that System control panels, detector nodes, battery backup modules and power boosters are all supplied with their own manuals. Their general specifications and performances are available both in their individual manuals and published data sheets. This data is not reproduced in this guide.

Failure to follow this installers guide could compromise operation of the 2-Wire gas detection system so please follow the enclosed information carefully.

Systems should be designed and installed by competent persons. A competent person being defined by the UK Health and Safety Executive as:

A competent person is someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular help you need.

IGD’s gas detection systems are capable of installation by electrical installation engineers. Design of a system is not covered in this guide and should be undertaken by a competent person. The design should include:

The Nature of the Gas Hazard and Appropriate Placement of Detectors
Clear Indication to workers That a Gas Hazard Exists and the Action They Must Take
Interaction Between the Gas Detection System and Other Systems
The Necessary Safe Operating Procedures That Must be in Place

IGD can provide help to design systems where help is required and can also provide training for surveyors, specifiers, designers and installers.

All Gas Detectors shipped from IGD are pre-calibrated. It is not always necessary to re-calibrate a newly installed system on site but it is recommended that commissioning is undertaken. Commissioning should be undertaken by persons trained to do so. Commissioning should ensure that the system performs and interfaces correctly to all connected devices, host systems and operates to the required cause and effect.

IGD are available to answer question using our on-line ticketing system available through our website.

NOTE that ATEX equipment has specific requirements for cable protection and glanding to housings. These requirements are detailed in manuals for such equipment available through our website.
SECTION 1

MOUNTING DETAILS FOR EQUIPMENT
Tocsin 750 Physical

Note 150W and 24V DC Versions Can be Flush mounted into walls up to the front face flange 300W Versions have active ventilation and must be surface mounted allowing 100mm clearance all round

Note that the rear case can be rotated to allow 20mm entries to face either up or down

Installation Cables

Supported Installation Cables 2 Core 1.5mmSQ or 2.5mmSQ See IGD Cable System Calculator

Typically SWA, MICC, FP200, SY, CY, H03VVH2-F Mains Cable Screened, screened or Similar
TOCSIN 635 and 650 PHYSICAL

Installation Cables

Supported Installation Cables 2 Core 1.5mmSQ or 2.5mmSQ See IGD Cable System Calculator

Typically SWA, MICC, FP200, SY, CY, H03VVH2-F Mains Cable Screened, screened or Similar
Mounting Details and Dimensions ATEX Versions

The ATEX version uses IGD’s JB3 series ATEX EXD terminal enclosure. Please note that cable glanding and sealing must conform to ATEX requirements which is more fully described in the ATEX JB3 manual.

Mounting Details and Dimensions Safe Area Versions

Gas Detector Types

Refer to individual data sheets for specific data relevant to available gas detectors, types, accuracies and sensitivities available.

For pellistor type gas detectors complying to BS EN 60079-29-0 and 1, these general purpose flammable gas detectors are suitable for Methane and LPG detection in the range 0-100% LEL.

Relative response to Methane @ 4.4% Vol = 100% LEL Equivalent to 48.4% LEL N-Butane
Battery Backup Modules

TOC-750-BAT1  7AH Battery Backup with 150W PSU

TOC-750-BAT2  17AH Battery Backup with 300W PSU
SECTION 2
SITING GAS DETECTORS
Siting Gas Detectors

Gas detectors usually fall into two groups for placement

1. Plant Protection. Typically flammable gas detectors fall into this category. Aside from asphyxiation flammable gases are typically not directly toxic and so detectors are placed strategically where the gas is expected to accumulate based on its relative density to air (lighter or heavier)

2. Life Safety Systems. Here the concern is that a toxic or asphyxiating gas is directly hazardous to personnel and so the gas detection is placed based on the normal operating zone for the people present

Note that in many cases both life safety and plant protection sensors may be appropriate on a site. For example a plant using liquid helium may have plant protection sensors at high level to ventilate roof spaces in the event of leaks. However in the event of ventilation failure Helium could accumulate down towards the zone where personnel operate. In this case a second set of life safety sensors would be appropriate.

Each site should be surveyed and assessed on its own merits. This document presents general guidance only.
High Concentrations Local to Release Source or Cloud Development Scenario

5M is a Maximum Detection Distance and Will be Effected by Topography. Gas Levels Will Drop as Distance to Leak Source Increases Requiring Lower Alarm Set Points.

For this CO2 Example use Detectors in the Life Safety Zone to Trigger Ventilation and Evacuation Alarms.

For this CO2 Example Expect Higher Concentrations at Low Levels. Use for Ventilation Trigger and Pre-Alarms.

100% CO2

This Example Illustrating A CO2 Gas Release From A Storage Cylinder. Typical Scenario, Broken or Blown off Hose, Regulator Incorrectly Connected, Ruptured Gauge or Similar.

Heavier Than Air Gases Can Show a Gradient in Room Levels With Higher Concentrations at Floor Level or Slow Leak Scenario.
Cryogenic Gas Detection

Applications involving Cryogenically cooled gases such as liquid Nitrogen or Helium need careful consideration for gas detection. On initial release as cryogenically cooled gases can typically be at lower temperature and high density than their surroundings they will behave differently than when in their gaseous state. In such cases it should be considered if two sets of detection is required, one for the life safety zone and one for low level detection in the gases cooled state. Applications involving such gases are recommended to be surveyed.

Area Coverage for Gas Detectors

In a similar manner to smoke detectors, a gas detector can provide up to 75SQ M area coverage based on a 5M radius of operation. There are many factors affecting this, geometry of a room, equipment in the area, gas characteristics, ventilation air flows etc. IGD can support throughout the survey, design and installation process to ensure the best possible result on site.

Calibration and service Requirements for Gas Detection Systems

All gas detection systems require regular checking and calibration to be in compliance with the UK factories act. The service and calibration period will be a function of the application based on environmental in service conditions. It is extremely important to ensure a service plan is in place for any gas detection system installed as part of a site safety system. IGD can work with operators to provide advice, service and spares to ensure an appropriate level of cover.
General Detector Mounting Positions Atex (BS EN 60079-29-1)

Detectors should be mounted vertically with the sensor face facing downwards to protect from contamination.

General Detector Mounting Positions Safe Area (BS EN 50194)

Sensor Facing Down

Sensor Mounted to Vertical Wall in Various Orientations

Do NOT Mount With The Sensor Facing Upwards
Detectors in Airflows Mounting Positions Atex (BS EN 60079-29-1)

Do NOT mount Detectors Where Airflows Are Likely to be Directed either onto or Away From the Sensor Face. This Situation May Result in Contamination and/or reduced Detection Capability.

Air Flows up to 6M/S Are Allowable Without Any Performance Issue Across the front of The Sensor Face.

Detectors in Airflows Mounting Positions Safe Area (BS EN 50194)

Air Flows up to 1M/S Are Allowable Without Any Performance Issue.
Siting System Components

Control Panels:

These should be located outside of the area protected by its connected gas detectors.

The control panel should be accessible such that in the event of an alarm the area can be evacuated and gas levels viewed from the controller.

Consider the use of mimic panels, HMI panels or GSM options available from IGD to provide additional remote indication/alarm

Audio-Visual alarms

As a general rule if there is gas detection fitted to an area then there should be an audio-visual alarm (beacon sounder) to alert personnel who may be in the same area. Typically these will be standard beacon sounders where the sounder can be silenced from the control panel once an alarm is accepted. Standard LED beacon sounder modules are available from IGD and can be run from addressable I/O points to minimise cabling. Another option is to fit IGD’s range of annunciators.

Annunciators

Annunciators are addressable devices typically fitted at door entry points. They provide a clear audible visual alarm in the event of a gas alarm to warn persons from entering an area where a gas hazard could be present.

They offer many advantages over standard beacon sounders. They can be fitted to standard dado trunking systems; cannot be confused with other alarms; the displayed alarm message and flashing colour display is unambiguous; they can be fitted with slam switches.

Gas Collector Cones and splash Guards

Where detectors are located above gas plant such as boilers or meters in rooms with high ceilings then consider the use of gas collector cones. These are fitted to detectors sited just above gas plant to enhance the detectors capability to detect gas leaks (see separate application note)

For detectors fitted at low level, fitting splash guards may be appropriate to protect sensors from dust, rain splash, floor washing etc.
SECTION 3
GENERAL CABLING PRINCIPLES
CABLE TYPES
AND
CABLE SIZING
Cable Type Guidance

IGD’s 2-Wire gas detection systems operate using screened cabling of appropriate cross sectional area. There are no specific requirements and our typical advised cable types are indicated below. Cable screens, either foil and drain wire, braid or armouring must be continuous between devices and grounded for effective operation. Ancillary devices such as stop buttons, beacons, sounders etc should commoned to the earth blocks provided as indicated below.

**Recommended Cable Preparation**

Strip Conductors 7mm Ensure No Stray Strands

**CY Style Cable**

CY Type cable has a braided screen which should be trimmed back to ensure no trimmed conductor ends up on sensitive PCB components, tracks or terminals where it may short. The screens of the incoming cables should be terminated to the floating terminal block provided to ensure screen continuity. Trim back any unused conductors and ensure the braid is insulated with heat shrink or insulation tape and/or sleeve.

**FP Style Cable (Preferred Option)**

FP style cable is fitted with a foil screen and drain wire. Generally this is easier to terminate than CY type cable. Trim back any unused cores and foil screen. Ensure the drain wire is insulated with suitable size sleeving and terminates to the cable screen terminal

**SWA Style Cable**

SWA style cables are usually only recommended for used with ATEX EXD housings where the universal cable glands ground the cable armour to the housing. This provides both an effective EMC screen and mechanical protection. Ensure unused conductors are trimmed back and isolated. If terminating to plastic enclosures fit ‘pan handles’ and terminate on the outside of the enclosure to ensure screen continuity
Main Base PCB Connectors

When unplugging detectors from the main PCB DO NOT lever them off. This will potentially cause damage to the PCB and/or connector mating parts and invalidate any warranty. If it is necessary to remove the PCB connectors use long nose pliers.

Note that connectors can be plugged either vertically or Horizontally to the PCB.
Cabling: When using stranded cable fit bootlace ferrules to prevent stray wire strands shorting. Cable glands must be used for cable entries.

System Example

Controller in Supervisors Office

Where Required For Longer Cable Runs or Where Device and Accessory Density is High add Power Boosters or Cascade Hubs to Increase Distance Capability to up to 3KM

Laboratory

Use Annunciators with Gas Detector Interfaces to Detect & Alarm in Specific Areas

Gas Bottle Store

Use Annunciators For Door Entry Control.

Mix Annunciators With Other Addressable Devices Such as TOC-750 Series Detectors. Use ATEX Rated detectors where required

ATEX Zoned Area

2 Core Highway as:
24V  L1,L2
Typically 1.5mmSQ Unscrenned Cable

Use the Detector or Annunciator I/O Capability to Control Gas Supply Valves, Beacon-Sounders or other devices
Interfacing to the Remote Modbus Port

The Tocsin 750 series controllers have an in-built memory map allowing access to alarm status, panel status, readings etc using Modbus RTU protocol. Wiring between units is as follows:

Master DCS/BMS

RS485 Modbus Comms Port

Screen
B
A
0V DC

Note only the A, B and 0V DC Connections are Used. 0V DC between master and slave should be connected for correct operation and to prevent damage to both master and slave systems.

More than one controller can be interfaced on the same Modbus cable by assigning individual Modbus addresses to each controller.

Refer to users guide for Modbus channel mapping

Cable Sizing

Up to 400m use minimum 1.0mm² cable with an overall cable screen.

Cable runs over 400m use 1.5mm² cable with an overall screen.
Interconnecting Modules On A Data Highway

Tocsin 750 Series Annunciator Modules are interconnected as follows using two core cable. The system is designed to operate using screened cable. In some circumstances, for instance in ATEX Zone 1 areas a protective armour may be desirable to provide mechanical protection. The system provides both power and digital communication over the single pair of wires. The system is also polarity insensitive although best practice would be to connect L1 to L1 and L2 to L2 etc for continuity. It is necessary to fit an IGD terminator at the last device as indicated for operation of the system. In-coming and out-going screens must be connected as indicated, ensuring screening continuity. IGD provide screw-less terminal blocks for this purpose. Ancillary cabling to push buttons, beacons, sounders etc should also be screened.

For 2-Wire Addressable Systems:

For Safe Area Detectors Use 2 Core Cable 1.0 to 2.5mmSQ Cable Depending on Distance.

Ensure Cable Screens are Correctly Terminated and cables are stripped to the enclosed guide.

For ATEX Units Typically Use 2 Core SWA Cable 1.0 to 2.5mmSQ Depending on Distance

See Cable Calculator for Cable Core Size vs Distance VS Number of Devices

End of Line Terminators Must be Fitted at the Last Module in Line as Indicated Across the L1 and L2 Terminals.
Terminators are Shipped With All Control Panels.
Spare Terminators Can be Ordered Using Part Number : TOC-750-TRM.
Failure to Fit Terminators Will Prevent System Operation
Cable Sizing

The total number of devices that can be supported on a cable highway will be limited by the reset fuse on the PCB, the cable length and size fitted and the power requirement for each module. The controller reset fuse is set to 2A. The following table is intended as a guide to show the number of devices that can be run taking into account the volt drop for differing cable sizes before boosters need to be employed.

### 1.0mm² Cable / 17AWG

<table>
<thead>
<tr>
<th>Length (M)</th>
<th>Toxic</th>
<th>Pellistor MK6/7*</th>
<th>Pellistor MK3**</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>32</td>
<td>32</td>
<td>23</td>
</tr>
<tr>
<td>500</td>
<td>32</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>750</td>
<td>26</td>
<td>14</td>
<td>9</td>
</tr>
<tr>
<td>1000</td>
<td>20</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

**Booster Module Required For Increased Detector Nodes Beyond Indicated Numbers**

### 1.5mm² Cable / 15AWG

<table>
<thead>
<tr>
<th>Length (M)</th>
<th>Toxic</th>
<th>Pellistor MK6/7*</th>
<th>Pellistor MK3**</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>32</td>
<td>32</td>
<td>25</td>
</tr>
<tr>
<td>500</td>
<td>32</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>750</td>
<td>32</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>1000</td>
<td>30</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>

**Booster Module Required For Increased Detector Nodes Beyond Indicated Numbers**

### 2.5mm² Cable / 13AWG

<table>
<thead>
<tr>
<th>Length (M)</th>
<th>Toxic</th>
<th>Pellistor MK6/7*</th>
<th>Pellistor MK3**</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>32</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>500</td>
<td>32</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>750</td>
<td>32</td>
<td>31</td>
<td>21</td>
</tr>
<tr>
<td>1000</td>
<td>32</td>
<td>26</td>
<td>18</td>
</tr>
</tbody>
</table>

**Booster Module Required For Increased Detector Nodes Beyond Indicated Numbers**

* – Also Ann & Toxic & Relay   – Also Ann & Toxic & Display   – Also Ann & Beacon/Sounder

** – Also Ann & MK6/7 & Relay   – Also Ann & MK6/7 & Display

**NOTES:**
1: Assumes PSU voltage is 26.5V
2: Assumes all Annunciators are spaced evenly on cable
3: Assumes on other outputs or inputs are disabled on Annunciator
4: Assumes voltage drop across Ann L1 to L1 is less than 25mV
5: Assumes voltage drop across Ann L2 to L2 is less than 25mV
6: Ann with T102A=0.6W, Ann with MK6/7=1.1W, Ann with MK3=1.6W
SECTION 4
MAKING DEVICE CONNECTIONS TO DETECTOR NODES
Mains Power and Controller Overview

Hub Card PCB Common to All Assemblies. Note entry level 635 version is a part populated PCB supporting fewer detectors.

PSU Options:
- 70W
- 150W
- 300W

All Closed Frame Stock Switched Mode PSU With their Own Approvals

Display Option 1 (750)
7” Colour Touch Screen HMI

Display Option 2 (650/635)
2 x 8 RGB LCD and Jog Wheel

Important

In all cases mains connection must be made via a 2-Pole Isolating supply

Where stranded cable is used for mains power termination, fit bootlace ferrules to ensure there is no possibility of stray wire strands
Mains Power and Controller Overview

Controllers with mains power supplies must be fed via a unique fused spur fused at 3A.

Use ferrules or 4mm fork crimps to prevent stray wire strands and potential shorting.

Note incoming Earth connection

Incoming Panel Earth  L  N

EMC Filter Ferrites

Earth Point for Cable Screens For Detector Nodes, Comm’s Connections

Note Position of EMC ‘Ferrite’ Over Comms Port Cable.

Power supplies are switched mode types.

Note dependent on PSU type the incoming voltage may require to be set using a switch setting between 110V AC and 230V AC. If this is the case note the current switch setting indicated on the PSU label before connecting power. If the setting requires changing to suit the incoming voltage then make this change before connecting power and re-label accordingly.

Failure to ensure the PSU is correctly set to match the incoming voltage will result in permanent damage.

CONTROLLERS MUST BE CORRECTLY EARTHED TO ENSURE CORRECT OPERATION
Connection Possibilities

The 750 Series Module PCB Operates as an Interface ‘Hub’ on the Addressable 2-Wire Highway. The Diagram Below Shows a Typical Set of Connection Possibilities

<table>
<thead>
<tr>
<th>Option</th>
<th>Type</th>
<th>Device</th>
<th>Device Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input</td>
<td>Gas Detector/Pellistor</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Input</td>
<td>Toxic Gas Detector</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Input</td>
<td>TOC-10</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Input</td>
<td>4-20mA</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Output</td>
<td>Relay &amp; OP1</td>
<td>102</td>
</tr>
<tr>
<td>6</td>
<td>Output</td>
<td>Solid State Output</td>
<td>103</td>
</tr>
<tr>
<td>7</td>
<td>Output</td>
<td>Solid State Output</td>
<td>104</td>
</tr>
<tr>
<td>8</td>
<td>Input</td>
<td>E-Stop</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Input</td>
<td>Key Switch</td>
<td>6</td>
</tr>
</tbody>
</table>

Device Address Table

I/O Port 2
Either Input or Output

I/O Port 1
Either Input or Output

Note that one 2-Wire addressable highway running Sentinel+ protocol can support up to 32 modules. Each module can have up to 8 connected devices. IGD Configuration software is used to configure the module PCB to switch devices on and off and set addresses (see Tocsin 650/750 Manual). If the connected devices have already been configured then the base address can be set from which all other module addresses will sequentially follow. This is described later in this manual. Device addresses indicated in the table are typical but can be individually set.
Module PCB Features

The following diagram indicates features available on the TOC-750 ‘module’ PCB. Please note that failure to observe and make correct connections or exceed ratings may result in damage to the PCB.

I/O Connection Port Selection Options
- 4-20mA Input 24V Powered From PCB
- 4-20mA Input 0V Powered Externally
- Voltage Input 0V 0-3V DC Analogue
- Digital Input 24V as contact closure
- Digital Input 0V External Logic Input
- SSR Output (SW+) Switched + DC 24V Output
- SSR Output (SW-) Switched - DC 24V Output
- SSR Dual For Beacon Sounder Operation

Module PCB Basic Interface Specifications

<table>
<thead>
<tr>
<th>1</th>
<th>Communication</th>
<th>IGD 2-Wire Highway Operating IGD Sentinel+ Protocol</th>
<th>Not Polarity Dependant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Relay</td>
<td>5A Non Inductive Loads 230V AC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Digital Output</td>
<td>24V DC 100mA Combined For Both Outputs Typically for LED Beacon Sounders</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Suitable for use with TOC-10 Link Function</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pellistor Port</td>
<td>Option to Interface to MK3, MK6 or MK7 Pellistors</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sounder</td>
<td>85dB (Option for TOC-750 Annunciators)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Display</td>
<td>2 x 8 Programmable LCD with RGB Backlight (Option for TOC-750 Annunciators)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Comm Port</td>
<td>Supports IGD Infra-Red, PID, Toxic and Oxygen Gas Detectors</td>
<td></td>
</tr>
</tbody>
</table>
Gas Detector Connection

The most commonly supplied detector node comes pre-fitted with a gas detector. The detector front assembly simply plugs onto the indicated connector. Note that all detector front assemblies have a common system address. The detector node module is designed to read the data from this address and report it back to the control panel using its own 'unique' address.

This makes service replacement very simple as the detector assembly is pre-calibrated and can just be plugged in to enable operation.

If detector modules are changed to add or change the detected gas type then the controller will need to be amended so the channel reads and scales correctly and so that alarm levels are appropriate.
The Detector Node relay output can be used as an alarm interface to external systems, run additional audio visual alarms or directly control other devices. Typical applications could be gas solenoid valves, boiler shut down interfaces or similar. When switching external loads it is important to consider the nature of the load being switched. For inductive loads suitable protection from induced back EMF must be fitted. Many modern devices conforming to the European EMC Directive may already have devices fitted as part of their design to limit in-rush currents and back EMF. Where these are not fitted the following two diagrams provide guidance. Failure to observe this may result in damage to the Detector Node.

**IMPORTANT NOTE:** Power to switch external devices is NEVER provided from the gas detection system and in all cases is from an external power source.

### Switching DC Loads

Example fit protection diodes when switching external DC loads. 1N4004 Diodes.

For Diode Packs
IGD PN: TOC-750-DIO

### Switching AC Loads

Example fit protection supressors when switching external AC loads typical device provided with each module 47R 1µF

For Additional Units
IGD PN: TOC-750-SNB
Solid State Output

Each Detector Node has 2 multi-function input - output ports. These can be configured independently as either 4-20mA inputs, Digital Inputs or solid state outputs. The solid state outputs are typically intended to switch small loads such as LED beacon sounder modules or small signal interface relays as indicated below. As standard Detector Nodes Ship with I/O Port 1 and 2 setup as Solid state outputs, negative switching.

Wiring to I/O Port 1 and 2
Select OUT SSR DUAL SW Option

The Solid State Outputs Can be used to Switch LED Beacon Sounders if Required.

It is recommended to use IGD LED Beacon Sounders Part Number 5083101. Connections Shown are for 5083101 and shown one output switching the beacon and one port switching the sounder. This allows the controller to mute the sounder on accepting an alarm.

When using Other Manufacturers Devices do Not Exceed 100mA @ 24V DC Total combined Load for Port 1 and Port 2. Use screened cabling.

When Switching Small interface relays ensure protection diodes are fitted as indicated, these are supplied with the module. Failure to do so can result in damage to the output. Ensure relay coil is rated at 24V DC and Max 100mA or Min 240 Ohms. Do not exceed 100mA Load Port 1 and Port 2.
Select OUT SSR SW+ or SW- Option.
Digital Input

Each Detector Node has 2 multi-function input - output ports. These can be configured independently as either 4-20mA inputs or solid state outputs. The digital inputs are typically intended to totalise pulse counts, mainly from gas meters, or use for slam switch/ E-Stop applications.

Wiring to I/O Port 1 and 2

If You Are Wiring Digital Inputs (24V) Option Then You Need to Include a 560 Ohm Resistor to Limit Current Around the Circuit

Select IN DIGITAL 24V Option

Screen cabling interfaced to I-O port 1 or 2. Typical Belden Style Security Cable 4502 FE, Foil Screen

If You Are Wiring Digital Inputs (0V) Option Allows Logic inputs from External Devices.

Anything Less Than 1.5V DC is Treated as Off Anything Greater is On

Select IN DIGITAL 0V Option

Solid State Input From TOC-10 Gas Detector

The Solid State Input can be used to interface to IGD TOC-10 Series Flammable Gas Detectors. Wire as Indicated and the Input Will Read the Two Alarm Levels From the TOC-10. This will display on an Addressable Controller in the Same Manner as Any Other Gas Detector. Up to 6 TOC-10 Detectors can be Daisy Chained to the Input

Select IN DIGITAL 0V Option
Digital Input.... Gas Meters

To be able to read a digital pulse train from a gas meter volt free contact or similar it is necessary to use adaptor cable part number TOC-750-GMA. The following diagram indicates fitting the cable and field wiring to a volt free contact.

The Solid State Input Will Accept up to a 0.2 Hz Pulse Train Input From a Gas Meter or Similar Device With a Volt Free Contact. The Following Scaling Options Are Available:

- 1 Pulse = 0.1M³
- 1 Pulse = 0.01M³
- 1 Pulse = 0.001M³

Select IN GM, 0V ... M3 Option, depends on the Gas Meter's Resolution.
4-20 mA Inputs

Each Detector Node has 2 multi-function input-output ports. These can be configured independently as either 4-20mA inputs or solid state outputs. When used as 4-20mA inputs any standard 4-20mA loop powered can be read in as an analogue signal. Using the setup routine the signal can be scaled and then read back addressably onto the system controller.

Wiring to I/O Port 1 and 2

a) For a 2 Wire Loop Powered Device
Select OUT 4-20MA 24V Option

The Input Sources a 24V DC supply then sinks the signal current on the module PCB across a 122 Ohm resistor on the PCB

b) For a 2 Wire 4-20mA Device Externally Powered Device
Select OUT 4-20MA 0V Option

24V DC Power is supplied from an external source then sinks the signal current on the module PCB across a 100 Ohm resistor on the PCB. Note if the externally powered sensor does not have an isolated output then a separate isolator must be fitted as indicated. These may or may not require external power. The IGD Option shown is loop powered PN TOC-MA-ISO
Pellistor (Catalytic) Flammable Gas Detector Interface

The Detector Node PCB is equipped with a Pellistor or Catalytic flammable gas detector interface. This supports all IGD manufactured pellistors as indicated below. Note that the correct pellistor option must be selected in the setup software routine for the pellistor to operate correctly.

The Pellistor can be mounted remotely from the PCB. When doing so do not exceed the indicated cable length.

For remote mounting use 1.5mmSQ Cable. Do not exceed 10M

This cable to the pellistor may need to be screened in electrically noisy environments. This will not normally be required if other items of heavy electrical equipment are not present.

IGD Pellistors Supported

<table>
<thead>
<tr>
<th>Type</th>
<th>Head Current</th>
<th>Head Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>MK3</td>
<td>ATEX EXD IIC T6</td>
<td>360mA</td>
</tr>
<tr>
<td>MK6</td>
<td>Safe Area</td>
<td>170mA</td>
</tr>
<tr>
<td>MK7</td>
<td>Safe Area</td>
<td>170mA</td>
</tr>
</tbody>
</table>

Note: The Pellistor 'Type' is selected using IGD service tool app or by using the setup routine in the TOC-750 Software. Once selected this automatically sets the head supply voltage.

In operation and with zero air applied correctly to the detector the ‘balance’ between the two detector ‘beads’ as measured P-Y and Y-W should not show a difference of more than 70mV. If the difference is larger than this then it could be an indication of aging or damage and the detector should be replaced.
SECTION 4
Control Panel Interfaces and Connections
Tocsin 650 and 750 Control Panel & New 2 Wire Hub PCB Features

*Ethernet
Rs485 Remote (Modbus etc)
*USB
Display Colour HMI
Display TOC-650 (2x8 LCD)
Fault Relay

Battery Connection
For Battery Backup
Bluetooth

Power in
24V DC

4 off 2 Wire Ports Each supporting 32 Devices
128 Devices in Total

Cable Highway 4
Cable Highway 3
Cable Highway 2
Cable Highway 1

Notes

Hub cards can be cascaded to add more ports if required

Two display options, either 650 style with jog wheel

or

HMI Style touch screen display

Note both displays can be fitted at the same time which can allow the HMI display to be remote from the panel and used as a system repeater or mimic.

Maximum of 32 Devices on a highway.

Maximum of 99 Sensor address on a highway.

Maximum of 99 Relay address on a highway.

Maximum of 2A per Highway Without Additional Power Booster Modules.
Panel Inputs 1 and 2 Cable 0

The 750 hub card is fitted with two digital inputs for use when interfacing to volt free contacts. These can be used for example with slam switches or a relay output from another system such as a fire alarm panel. They appear during a FIND command on cable 0 (internal to the hub card) and will have input addresses 1 and 2 assigned by default. Alarms can be set against these two channels in the same manner as any other detector. Note these channels are supplied linked out and will always be the first two channels on the control panel.

Switched inputs 1 and 2, volt free contacts
Normally Closed Loops Opening on Alarm

Slam Switches
Address = 1

Key Switches
Address = 2

Alarm and Fault Relays

Fault 101
Relay 102
Relay 103
Relay 104

All Relay NO COM NC

24V DC
COMM

FOR DC LOADS DO NOT EXCEED 30V DC 5A

Example fit protection diodes when switching external DC loads. 1N4004 Diodes are provided with each module.

For Additional Diode Packs
IGD PN: TOC-750-DIO

The four relays included on the hub card can be assigned to alarm levels in the relay alarm routine. They appear on internal cable 0 during a relay FIND.

All 4 relays are normally energised, de-energising on alarm or on loss of power to panel.
Panel Beacon Sounder Output

The 750 hub card is fitted with two SSR outputs intended for use with Beacon Sounders. During a FIND command these will appear on cable 0 (internal to the hub card) and can be assigned to alarm levels during the alarm setup routine. Addresses will be assigned as 105 and 106 during the FIND operation.

The 750 Hub Card also incorporates a built in sounder. This also has its own address and will appear by default as relay O/P 107 after a FIND operation.

Panel Displays

Two display option are available. A 2 x 8 RGB LCD, supplied as standard on the 650 model and a colour HMI touchscreen supplied as standard on the 750 model. Both run from different ports on the same hub card.

TOC-650 Style display connects using a ribbon cable interface and must be local to the hub PCB

TOC-750 Style display connects through an RS485 Interface which allows the display to be remote from the hub if required

Note the hub PCB can run either display, both together with the HMI display remote or the hub can run ‘blind’ with no connected display.
Tocsin 650/750 Addressable Relay Card

Power out for use in conjunction with relays

Relay status LED, ON when Energised

0V DC

24V DC

10 off Digital/Analoge Input Ports

2-Wire Highway Connections

Pin 1 Line 1
Pin 2 Line 2

Pin 1 Line 1
Pin 2 Line 2

Example fit protection diodes when switching external DC loads.

In all Cases:

Relay contact ratings.
5A @ 250V AC Non-Inductive
5A @ 30V DC Non-Inductive

Spike suppression must be fitted

Note that FAULT relays are normally energised on power up.

Base Address set up LED's and interface for the relay card

Cable Screens Must Be Connected and be Continuous
Tocsin 650/750 Addressable Relay Card Input Ports

Relay cards also have analogue and digital inputs that can be used to read data onto the system from external devices. Setup of the inputs, type, range, addressing etc is controlled via IGD’s Android Apps. Wiring options are indicated below. Note the differences between Version 1 and 2 PCB assemblies.

Note 1: These Ports are designated to be digital inputs only.

Note 2: These Ports are not used on version 1 PCB assemblies limiting the PCB to a maximum of 6 analogue inputs or 8 digital inputs including ports 9 and 10.
Cascading Controllers and/or Hubs

Hub cards can be cascaded together. This can be to allow master and slave panels to network systems together or to gain extra distance on a cable network or add more cable highways. The two wire system can be cascaded down two levels. With its capability to transmit up to 1000M, cascading down 2 levels means systems can be up to 3KM long.

Note that on the top level master panel only cable 1 and cable 2 support cascading.

Hubs cards can operate without displays and can be DIN rail mounted into enclosure systems such as IGD’s range of field boxes.

IMPORTANT NOTE

The Cascaded links between panels are polarity sensitive as:

+L1 - L2 +L1 -L2

Failure to observe this will result in damage to the hub card

Ensure Cable Screens Are Earthed to PSU Earth.

In this example the main master panel at the start of the cascade will see all the detector nodes and relay cards installed on panels below it.

Cabling between panels/hubs can be up to 1000M

Ports not used for cascading links each support 32 detector nodes or relay cards.
External Battery Backup and Power Booster Modules

Both the 650 and 750 series 2-Wire control panels can accommodate 5AH internal batteries for battery backup. If battery backup is required for longer time periods than the internal batteries allow then external battery backup units can be employed.

Two external battery back options are available. 7AH and 17AH as follows:

- **TOC-750-BAT1** (650 or 750 Series Controller): 7AH Option (150W PSU)
- **TOC-750-BAT2** (650 or 750 Series Controller): 17AH Option (300W PSU)

Note that the main control panel needs to be a 24V DC version as the external battery backup units house a mains power supply. The battery backup modules should be fed from a mains fused spur.
Device Loadings for Battery Backup Run Time Calculation

Indicated power is with the device in full alarm with all its I/O points energised.

<table>
<thead>
<tr>
<th>Device</th>
<th>Max Power in Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOC 750 Controller</td>
<td>13</td>
</tr>
<tr>
<td>TOC 650 Controller</td>
<td>7.9</td>
</tr>
<tr>
<td>External Hub Card</td>
<td>7</td>
</tr>
<tr>
<td>Relay Card (All 8 Relays Energised)</td>
<td>8.5</td>
</tr>
<tr>
<td>I/O Node</td>
<td>1</td>
</tr>
<tr>
<td>IR/Pellistor/PID Detector Node</td>
<td>1.24</td>
</tr>
<tr>
<td>IR/Pellistor/PID Detector Node with MK6/7 Pellistor, Relay On</td>
<td>1.64</td>
</tr>
<tr>
<td>Toxic Gas/ Oxygen Detector Node</td>
<td>1.1</td>
</tr>
<tr>
<td>Toxic Gas/ Oxygen Detector Node with MK7 Pellistor</td>
<td>1.73</td>
</tr>
<tr>
<td>Node with 2 x 8 RGB Display</td>
<td>1.89</td>
</tr>
<tr>
<td>Node With MK6/7 Pellistor &amp; 2 x 8 RGB Display</td>
<td>2.52</td>
</tr>
<tr>
<td>IGD Beacon Sounder (PN 5083101)</td>
<td>1.2</td>
</tr>
<tr>
<td>Cable Dissipation 1000M 1.0mmSQ (Approximation)</td>
<td>4.25</td>
</tr>
<tr>
<td>Cable Dissipation 1000M 1.5mmSQ (Approximation)</td>
<td>2.17</td>
</tr>
<tr>
<td>Cable Dissipation 1000M 2.5mmSQ (Approximation)</td>
<td>1.18</td>
</tr>
</tbody>
</table>

Example

Item 1: Tocsin 650 Controller internal 5AH Battery
Item 2: 4 off Toxic Gas Detector Nodes for Ammonia
Item 3: 2 off Oxygen Gas Detector Nodes
Item 4: 2 off IR Gas Detector Nodes for CO2
Item 5: 3 off Beacon Sounders

Calculation

Available Battery Power = 5AH x 24V = 120 Watt Hours

Total Device Power =
- Item 1: Power = 7.9W
- Item 2: Power = 1.1 x 4 = 4.4W
- Item 3: Power = 1.1 x 2 = 2.2W
- Item 4: Power = 1.24 x 2 = 2.48W
- Item 5: Power = 1.2 x 3 = 3.6W

1000m of 1.5mmSQ Cable Power = 2.17W

Total System Power = 22.75 x 1.2 (de-rating factor) = 27W

Run Time = 120/27 = 4.4 Hours
Power boosters are used where the control panel cannot supply enough power for the installed cable system. This may be due to the cable size being too small resulting in a large volt drop over the cable run or that there are a large number of devices drawing power. Booster modules are mains powered and can have an internal battery backup if required. There are IN and OUT connections such that the booster can be located at the end or part way down a cable run. Typically the booster should be located at the point that the cable voltage drops to 22V DC or if this is not known and boosters are planned from the start then located at the end of a cable run.
IGD Installations are undertaken to the requirements of BS7671 amendment 3 2015, in particular Regulation 521.11.201. Note that this is not concerned with placement of gas detectors but relates to the installation cabling requirements.

In addition to BS6761 there are other relevant standards relating to cable segregation to minimise electrical interference. In the UK are B6701:2016, which is a safety standard, and BS EN 50174-2 Information technology - Cabling installation - Part 2: Installation planning and practices inside buildings. BS EN 50174-2 is more concerned about the electromagnetic compatibility issues (interference) between power and data cables, rather than safety, but does state that safety issues take precedence over EMC issues. Within the Process sector, the current guidance is BS6739:2009 - Code of practice for instrumentation in process control systems: installation design and practice. For this standard IGD addressable systems are considered as Classification 4. Communications signals. This group includes fieldbuses, ethernet and other digital communication systems such as CAN-based systems, and analogue/digital hybrids.

For our purposes a power cable is defined as above 50 V AC with a 10 A rating

In General

- Parallel runs of instrument cables and power cables should be avoided; however, where unavoidable, adequate physical separation should be provided. A spacing of 200 mm is recommended from a.c. power cables up to 10 A rating. For higher ratings the spacing should be progressively increased.

- Where a cross-over between signal and power cables is unavoidable, the cables should be arranged to cross at right angles with separation of at least 200 mm maintained by positive means.

- Power and gas detection cables are installed with a 200 mm separation wherever possible.

- A 600 mm separation should be maintained between gas detection cabling and three phase power cables.

- Where 200 mm separation isn’t possible then the reduced distances of Table 3 may be used.

- A 50 mm separation must be included as defined in BS 6701

- A suitably earthed armoured power cable may be considered as ‘screened’ for the purposes of cable segregation.

- Failure to observe the above rules may lead to non-compliance with The Electricity at Work Regulations 1989 and the EMC Regulations 2006 (SI 2006/3418) July 2007

- Failure to observe the above rules may lead IGD to withdraw any terms of Warranty associated with their Gas Detection products for the specific installation concerned.

<table>
<thead>
<tr>
<th>Type of installation</th>
<th>Without a divider</th>
<th>With a non-metallic divider</th>
<th>Aluminium divider</th>
<th>Steel divider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unscreened power cable and unscreened IT cable</td>
<td>200-mm</td>
<td>200-mm</td>
<td>100-mm</td>
<td>50-mm</td>
</tr>
<tr>
<td>Unscreened power cable and screened IT cable</td>
<td>50-mm</td>
<td>50-mm</td>
<td>50-mm</td>
<td>50-mm</td>
</tr>
<tr>
<td>Screened power cable and unscreened IT cable</td>
<td>50-mm</td>
<td>30-mm</td>
<td>50-mm</td>
<td>50-mm</td>
</tr>
<tr>
<td>Screened power cable and screened IT cable</td>
<td>50-mm</td>
<td>0-mm</td>
<td>50-mm</td>
<td>50-mm</td>
</tr>
</tbody>
</table>

Table 3: Worst case conditions of EN 50174 and BS 6701 overlaid on each other

The Following Examples Show Typical Cabling Schemes
Typical Industrial Installation Scheme A

Cabling Fitted to Tray Using Stainless Steel Cable Ties

200mm Basket Tray Fixed Using Fasteners in Accordance with BS7671 amendment 3 Reg 521.11.201

Detector Node Mounted to Basket Tray Adaptor Plate

Tag Plate Available as an Option to Match Control Panel Screen Display Location Tags. If Required Order as TOC-TAG-A and supply Table of Required Tag Descriptions

Ceiling Height Basket Tray Typically 50mm

Preferred Cable Type 2 Core FP200 Min 1.5mmSQ, Check Cable Sizing to IGD Guide

Accessory Cables Typically Belden Style Security Cable 4502 FE, Foil Screen, 4 Core and Drain Wire 0.75mmSQ

IGD Supplied Beacon Sounders Supplied With GAS ALARM Legend. 2 off Can be Run From Each Detector Node

Snap Fit M20 Cable Glands With Face Seal Supplied With Detector Nodes (2 Per. Additional Units Supplied in 5 Pack PN TOC-GLAND

Installation to be in Accordance with BS6761 amendment 3 Reg 521.11.201, BS EN 7671:2008, BS EN 50174-2, BS EN 6701:2016 and BS6739:2009
Note Conduit Size Large Enough For One FP200 Cable Run and Accessory Cable Type 4502 FE
20mm Plastic Conduit Mounted Using Metal Saddles and Fixings to be Compliant With BS7671 amendment 3 Reg 521.11.201

IGD Supplied Beacon Sounders Supplied With GAS ALARM Legend. 2 off Can be Run From Each Detector Node

Preferred Cable Type 2 Core FP200 Min 1.5mmSQ, Check Cable Sizing to IGD Guide

Tag Plate Available as an Option to Match Control Panel Screen Display Location Tags. If Required Order as TOC-TAG-A and supply Table of Required Tag Descriptions

Installation to be in Accordance with BS6761 amendment 3 Reg 521.11.201, BS EN 7671:2008, BS EN 50174-2, BS EN 6701:2016 and BS6739:2009

DO NOT Attempt to Enlarge 20mm Entries, This Will Invalidate Warranty and Damage Enclosure Sealing.
20mm Plastic Conduit Mounted Using Metal Saddles and Fixings as Required to be Compliant With BS7671 amendment 3 Reg 521.11.201

Note Conduit Size Large Enough For One FP200 Cable Run and Accessory Cable Type 4502 FE

DO NOT Attempt to Enlarge 20mm Entries, This Will Invalidate Warranty and Damage Enclosure Sealing.

Gas Detectors Mounted Above/Below Dado Style Wall Trunking System.

Ensure Segregation From Mains Cabling. Ensure Cable is Only Run in Trunking Data Compartments. Where Other Cables Use This Compartment Ensure They Are Only Data Cables. Do Not Run Any Mains Powered Loads Through The Data Section of the Trunking

Installation to be in Accordance with BS6761 amendment 3 Reg 521.11.201, BS EN 7671:2008, BS EN 50174-2, BS EN 6701:2016 and BS6739:2009
Installation Requirements for Samplers

Interconnecting Highway Cabling
For 2-Wire Addressable Systems:

For Safe Area Detectors Use 2 Core Cable 1.0 to 2.5mmSQ Cable Depending on Distance.

Ensure Cable Screens are Correctly Terminated and cables are stripped to the enclosed guide.

See Cable Calculator for Cable Core Size vs Distance VS Number of Devices

Refer to TOC-750 Series Sampler Manual for Full Details

A variety of End of Line Termination Points Are Available Contact IGD For Further Details

Tubing 6 x 4 Polyurethane Other Tube Options Available Do Not Exceed 20M

Connect screens as indicated to ensure screen continuity
Installation Requirements for No-Volt Release Modules

No Volt-Release modules are fitted in situations where user intervention is required after resetting a gas alarm before a signal is re-instated.

An example of its use would be where an output from the gas detection system is being used to control a gas supply to a process. On detecting a gas leak the system shuts off the gas supply. If a normal relay is used then on resetting the gas alarm the relay will also re-set and automatically bring back on the gas supply. This may not be desirable. For example if the gas supply is feeding bunsen burners in a lab, then there may be a number of open taps which would potentially leak unburnt gas if the supply automatically re-instates. By fitting a no-volt release module to control the power to the gas valve this then requires manual re-set of the supply before it is re-instated. With the module fitted, to re-instate the supply; there must be no gas alarm or other alarm on the system controller, the e-stop on the no-volt release must be in the safe position. At that point the supply can be manually re-instated.

Unit provides a volt free contact rated at max 30A 250V AC
Note this is a volt free contact designed to switch an external load powered from an external supply.
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