I-GARD Falcon Arc Protection System
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1. GENERAL INFORMATION ON ARC PROTECTION

The Falcon Arc Flash Protection System is designed and built to protect the operating personnel and to reduce damage to electrical equipment in case of an arc. An arc progresses at a speed of 300 m/s, burning and consuming all materials in the short circuit current path. The arc remains as long as there is enough power to maintain it. In order to extinguish an Arc Protection System must detect the presence of an arc and provide a trip signal to an interrupting device to isolate the arc immediately.

The I-Gard-FALCON Arc Protection System detects and initiates the tripping signal in less than 1 ms. The Arc Protection System will reduce the incident energy produced by an arc, it can assist in mitigating the risks of Arc Flash exposure to operating personnel during repairs and installations.

2. GENERAL DESCRIPTION OF THE I-GARD-FALCON ARC PROTECTION SYSTEM

The I-Gard-FALCON Arc Protection System uses advanced microprocessor technology to control the functions of the system. This technology provides the capability to configure the trip functions of the Arc Protection System to match all the different power distribution designs and alternate switching arrangements.

The I-GARD-FALCON Arc Protection System utilizes Solid State Relay technology that ensures tripping sequence occurs in the shortest possible time, reaching the trip coil of supply circuit breakers in less than 1 ms after the arc has been detected either by the I-GARD-Falcon Master Unit or the Falcon-ARC arc slave unit, and/or the pre-set current value has been exceeded in the Falcon-CR Current Unit.

The system is fully customizable to suit the specific arrangements of the switchgear and can be deployed using light only or light and current for detection purposes.
The I-Gard Falcon Master Unit uses photoelectric technology to ensure integrity of the system and is impervious to magnetic interference.

3. CONFIGURATION

3.1 General

The I-GARD-FALCON Arc Protection System consists of a Master Unit which utilizes four dedicated channels which may be used for either current or light sensing. With respect to each channel the user may connect up to a maximum of six (6) slave modules. Slave modules can be either ARC slave units for light detection or CR Units for over-current detection.

Each Master Unit can be configured to a maximum of twenty (20) light only inputs or can be expanded using additional slave units.

One I-GARD-Falcon Master Unit can protect several sections of the switchgear simultaneously. In this case the Arc and Current Units in the Protection System shall, of course, be located in different sections. The light and current detection will be then be relayed to the Master Unit through the photoelectric cable. The Master Unit receives all the data and determines the tripping sequence according to the configuration.

Photoelectric and data (RJ45) cables are used to transmit information between the Master Unit as well as the Arc and Current slave Units. The Master Unit monitors all inputs through the RJ-45 data cable, including alarms, and Self-Diagnostics information via the data transmission cable.
Based on the inputs the Master Unit can isolate up to four devices using either Solid State Relay relays in less than 1ms or five conventional electromechanical relays.

The figure below is an example of a general arrangement.
3.2 I-GARD-Falcon Master Unit

The I-Gard FALCON Arc Protection System Master Unit can be utilized for either light sensing only or a combination of light and over-current which is recommended for all applications. In either case isolation is achieved in less than 1 ms.

The dial on the front of the Master Unit is used to adjust the activation threshold (intensity of light) for 16 Light inputs, identified as 1 to 16, located on the back plate of the Master Unit.

An additional four photo (light) inputs located on the back of the Master Unit identified as L1 to L4 can be utilized for light only or a combination of slave units. In either case the position of the DIP switch on the back of the Master Unit shall be positioned accordingly.

If no slave units are being used and inputs L1 to L4 are allocated for Light sensing the corresponding DIP switch must be in the ON position. This allows the dial selector on the front of the Master Unit to adjust the activation threshold of the corresponding L input.

When slave units, either ARC or Current, are installed to the Master Unit they will be connected to one of the channels D1 to D4, which are paired to corresponding Light inputs L1 to L4. A maximum of six (6) slave units may be daisy chained to each channel. In this configuration D1 to D4 provide Data transmission between the Master Unit and each of the slave units, L1 to L4 provide optical sensing from the slave units to the Master unit.
3.3 Falcon-ARC Arc Slave Unit

The Falcon-ARC (arc slave unit) is designed to provide additional light inputs, particularly when the number of sensor inputs located on the back of the Master Unit is not sufficient, or when there is a need to enhance the tripping sequence of the I-Gard –FALCON ARC Protection System. Each ARC slave unit provides an additional ten (10) light sensing inputs per module. Installing the ARC slave unit closer to the actual sensing points inside the equipment provides costs savings as a single photoelectric cable is required to interconnect either an additional slave unit and/or the Master Unit.

The activation threshold (intensity of light) for tripping may be adjusted using the dial selector located on the cover of the ARC slave unit. In the same fashion as in the adjustment of the activation threshold of the Master Unit the adjustment performed on the Arc slave unit sets the activation threshold of all the light inputs of the specific unit.

We recommend adjusting the activation threshold once the installation is complete when all the necessary photoelectric cables have been installed and connected to the ARC slave unit.

Additional ARC slave units can be daisy chained, to a maximum of six per channel, increasing the number of light inputs (arc detection points inside the electrical equipment) to sixty (60).

The I-Gard FALCON ARC Protection System will identify the exact sensor where the light threshold, previously set, has been exceeded, and all information will be displayed on the front of the Master Unit. Refer to section 5.4 of this manual.
3.4 Falcon-CR Current Unit

The FALCON-CR (current slave unit) is designed to provide over-current detection to the I-Gard FALCON Arc Protection System. The FALCON CR unit will detect the presence of an over-current condition. When the light activation threshold has been exceeded, the FALCON CR unit enhances the tripping sequence eliminating the risks of nuisance trips.

The FALCON-CR accepts current inputs from any of 5A, 2A or 1A secondary current transformers. The secondary terminals of the current transformers are connected directly to the terminal block in the back of the current slave unit.

The over-current activation threshold in the FALCON CR Unit may be adjusted using the dial selector on the front of the unit. The adjustment may be set between 50% and 500% of the input current.

It is important to remember that the coordination of the FALCON-CR with the FALCON ARC is verified properly during the commissioning of the overall system. The I-Gard FALCON Protection System will not trip when the Falcon-CR current slave unit is used in the Protection System and the pre-set over-current value is not exceeded by the arc.

Additional CR slave units can be daisy chained, to a maximum of six per channel increasing the number of over-current sensing inputs (arc detection points inside the electrical equipment) to six (6).

The I-Gard FALCON ARC Protection System will identify the exact sensor where the over-current threshold, previously set, has been exceeded, and all information will be displayed on the front of the Master Unit. Refer to section 5.4 of this manual.
3.5 Power Supply

The I-Gard FALCON Protection System requires a separate power supply that provides a regulated 12 Volts DC to the Protection System. The Power Supply may be mounted directly or on a DIN rail inside the control cabinet. The power Supply feeds the Master Unit. Both the Arc and Current slave units are fed from the Master Unit through the RJ-45 data cable.

4. TECHNICAL SPECIFICATIONS FOR THE EQUIPMENT INCLUDED IN THE SYSTEM

4.1 I-GARD-Falcon Master Unit

4.1.1 Technical Specifications

<table>
<thead>
<tr>
<th>I-GARD-Falcon Main Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage</td>
</tr>
<tr>
<td>Power Consumption</td>
</tr>
<tr>
<td>Inputs</td>
</tr>
<tr>
<td>16 Light Inputs 1 to 16</td>
</tr>
<tr>
<td>4 Light Inputs L1 to L4</td>
</tr>
<tr>
<td>4 Data Transmission ports D1 to D4</td>
</tr>
<tr>
<td>Outputs</td>
</tr>
<tr>
<td>4 Solid State Relay momentary output contacts</td>
</tr>
<tr>
<td>Nominal 5A, 600Vpeak</td>
</tr>
<tr>
<td>Maximum 25A&lt;1s</td>
</tr>
<tr>
<td>Peak Itsm=175A</td>
</tr>
</tbody>
</table>
### Outputs
6 Electromechanical latching relay output contacts. 
Form “A” Normally open 
Nominal 5A, 250VAC | Potential-free change-over contact, Configurable

### Minimum Tripping time
Less than 1 ms | Configurable

### Display
2-colour LED | Normal Function: solid green light 
Alarm: Solid red light when pre-set illuminance value is exceeded 
Alarm: flashing red: alarm detected but no longer present.

### Display Messages
7-segment Display | (Normal Function/Alarm/Trip) See message table in section 5.4

### Adjustment of Light Sensitivity
10klx…50klx | Located on the front of the master unit.

### DIP-Switches
L1 to L4 Light only = ON Position 
Slave units L1 to L4 = OFF Position | Tripping/Light Signal

### Test/Re-Set Button
Test | System Testing under no alarm condition press once.
Reset | Press once for every alarm that needs to be cleared.

### Tests
EN50081-1, EN50082-2 | (Compliance with the EMC-Standard)

### DNV
Vibration | According DNV No2.4 clause 3.6 Class A
Dry heat | According DNV No2.4 clause 3.7 Class B
Damp heat | According DNV No2.4 clause 3.8 Class B

### Operating Environment
Operating Temperature 0 to +70°C (32 to 158 oF) 
Storage Temperature -25 to +85°C (-13 to 185 oF)

### Measurements
92*mm. (7.6") W 196* mm. (7.7") L, 172 mm. (6.8")H

### Weight
1.7kg (3.7 lb)

*Table #1 I-GARD Falcon Main Unit Technical Specifications*
Wiring the Master Unit

The light sensors are connected to the Master Unit, directly to the Light inputs located on the back of the Master Unit-on the left side and identified with the numbers 1 to 16.

![Figure #2 Back of the Falcon Master Unit](image)

The data transmission cables going to either the Arc or Current slave units are connected to data transmission ports D1 to D4. Each data transmission port has a corresponding Light input L1 to L4 to which photoelectric cables from either the Arc or Current slave units are connected.

![Photo #6 Inserting fiber optic into the light input of Master Unit](image)

The Dip switches located at the top of the back plate are numbered 1 to 4. These are used to set default values for the corresponding light inputs L1 to L4. The first switch in the Dip switch corresponds to photo input L1, the second dip switch corresponds to L2 and so forth. With the Dip switch in its ON position, a light sensor can be connected to it, and the light detection level for this sensor can be adjusted using the dial selector on the front of the Master Unit. When the Dip switch is in its OFF position, it is used to transmit the tripping signal from either the Arc or Current slave units. If no photo-electric cable is connected to any of the Light inputs L1 to L4, the corresponding Dip switch shall remain in its ON position.

![Photo #7 Assigning Channel 1 for a Slave Unit](image)
The terminal block located on the right side of the back plate provides the alarm and trip contacts as well as the terminals which feed the auxiliary voltage from the power supply. The Solid State Relay relay output contacts are located in the top section of the terminal block and the electromechanical relay output contacts are located in the bottom section of the terminal block.

In order to ensure the operating conditions of the Master Unit the Lens protector pins that are supplied with the unit must be inserted in all light inputs that are not being used, reference sensors 1 through 16 and L1 through L4.
I-GARD-Falcon Master Unit terminal identification.

**Top Terminal Block**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. t1</td>
<td>1st Solid State Relay output</td>
</tr>
<tr>
<td>2. trc</td>
<td>Auxiliary voltage to 1st Solid State Relay output</td>
</tr>
<tr>
<td>3. t2</td>
<td>2nd Solid State Relay output</td>
</tr>
<tr>
<td>4. t2rc</td>
<td>Auxiliary voltage to 2nd Solid State Relay output</td>
</tr>
<tr>
<td>5. t3</td>
<td>3rd Solid State Relay output</td>
</tr>
<tr>
<td>6. t3rc</td>
<td>Auxiliary voltage to 3rd Solid State Relay output</td>
</tr>
<tr>
<td>7. t4</td>
<td>4th Solid State Relay output</td>
</tr>
<tr>
<td>8. t4rc</td>
<td>Auxiliary voltage to 4th Solid State Relay output</td>
</tr>
<tr>
<td>9.</td>
<td>Ground (Bonding)</td>
</tr>
<tr>
<td>10.</td>
<td>Ground (Bonding)</td>
</tr>
<tr>
<td>11. 12VDC-</td>
<td>Auxiliary voltage from the source of power</td>
</tr>
<tr>
<td>12. 12VDC+</td>
<td>Auxiliary voltage from the source of power</td>
</tr>
</tbody>
</table>

**Bottom Terminal Block**

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. r1no</td>
<td>1st relay output</td>
</tr>
<tr>
<td>14. r1c</td>
<td>Auxiliary voltage to 1st relay output</td>
</tr>
<tr>
<td>15. r2no</td>
<td>2nd relay output</td>
</tr>
<tr>
<td>16. r2c</td>
<td>Auxiliary voltage to 2nd relay output</td>
</tr>
<tr>
<td>17. r3no</td>
<td>3rd relay output</td>
</tr>
<tr>
<td>18. r3c</td>
<td>Auxiliary voltage to 3rd relay output</td>
</tr>
<tr>
<td>19. r4no</td>
<td>4th relay output</td>
</tr>
<tr>
<td>20. r4c</td>
<td>Auxiliary voltage to 4th relay output</td>
</tr>
<tr>
<td>21. pr5no</td>
<td>Undervoltage or Power loss alarm relay to 5th relay output</td>
</tr>
<tr>
<td>22. pr5c</td>
<td>Auxiliary voltage Undervoltage or Power loss alarm relay to 5th relay output</td>
</tr>
<tr>
<td>23. r6no</td>
<td>6th relay output</td>
</tr>
<tr>
<td>24. r6c</td>
<td>Auxiliary voltage to 6th relay output</td>
</tr>
</tbody>
</table>
### 4.2 Falcon-ARC ARC slave unit

#### 4.2.1 Technical Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Falcon-ARC ARC slave unit</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Auxiliary Voltage</strong></td>
<td>12VDC</td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>1W</td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
</tr>
<tr>
<td>10 Light Inputs</td>
<td>Each input is identified by the</td>
</tr>
<tr>
<td></td>
<td>Master unit</td>
</tr>
<tr>
<td>1 RJ45 Data Transmission Cable</td>
<td>Auxiliary Voltage, Alarms, Self</td>
</tr>
<tr>
<td></td>
<td>Diagnostics</td>
</tr>
<tr>
<td><strong>Outputs</strong></td>
<td></td>
</tr>
<tr>
<td>1 Fibre optical cable</td>
<td>Tripping Signal,</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1 RJ45 Data Transmission Cable</td>
<td>Auxiliary Voltage, Alarms, Self</td>
</tr>
<tr>
<td></td>
<td>Diagnostics</td>
</tr>
<tr>
<td><strong>Tripping Time</strong></td>
<td>&lt; 1 ms</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>3-colour LED</td>
</tr>
<tr>
<td></td>
<td>Normal Function: Slow Flashing green light</td>
</tr>
<tr>
<td></td>
<td>Met but not exceeded threshold:</td>
</tr>
<tr>
<td></td>
<td>Solid Amber Light</td>
</tr>
<tr>
<td></td>
<td>Alarm: Solid red light when pre-set illuminance value is exceeded</td>
</tr>
<tr>
<td></td>
<td>Alarm: flashing red: alarm detected but no longer present.</td>
</tr>
<tr>
<td><strong>Adjustment of Light Sensitivity</strong></td>
<td>10klx…50klx</td>
</tr>
<tr>
<td><strong>DIP-Switches</strong></td>
<td>Dial selector located on the front of the unit</td>
</tr>
<tr>
<td><strong>Test/Reset Green Button</strong></td>
<td>Reset</td>
</tr>
<tr>
<td></td>
<td>Test</td>
</tr>
<tr>
<td></td>
<td>The Test function is operated with the same switch used for resetting the unit. Maintain the button pressed, without releasing, for at least 5 seconds.)</td>
</tr>
<tr>
<td><strong>Tests</strong></td>
<td>EN50081-1, EN50082-2</td>
</tr>
<tr>
<td><strong>DNV</strong></td>
<td>Compliance with the EMC standard</td>
</tr>
<tr>
<td><strong>Vibration</strong></td>
<td>According DNV No2.4 clause 3.6 Class A</td>
</tr>
<tr>
<td><strong>Dry heat</strong></td>
<td>According DNV No2.4 clause 3.7 Class B</td>
</tr>
<tr>
<td><strong>Damp heat</strong></td>
<td>According DNV No2.4 clause 3.8 Class B</td>
</tr>
<tr>
<td><strong>Operating Environment</strong></td>
<td>Operating Temperature 0 to +70°C (32 to 158 oF)</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>-25 to +85°C (-13 to 185 oF)</td>
</tr>
<tr>
<td><strong>Measurements</strong></td>
<td>I 16 mm. (4.56&quot;) W 105 mm. (4.13&quot;) L, 44 mm. (1.73&quot;) H</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>0.7kg (1.54 lb)</td>
</tr>
</tbody>
</table>

*Table #2 ARC Slave Unit Technical Specifications*
4.2.2 Wiring the ARC slave unit

The photoelectric cables (fibre-optical) that transmit the information from the light sensors are connected to the inputs located on the back of the ARC slave unit. The light inputs are numbered 0 to 9 (zero to nine).

The outgoing RJ45 data transmission cable linking the Master Unit or other ARC slave units within the daisy chain are connected to the “Data-Out” port on the ARC slave unit. Correspondingly, the fibre optical cable transmitting the trip signal is connected to the “Trip-Out” photo terminal on the ARC slave unit.

The incoming RJ45 data transmission cable from another ARC slave unit within the daisy chain (same channel), is connected to the “Data-in” port. Correspondingly, the incoming fibre optical cable will be connected to the “Trip-In” input terminal.

The equipment bonding terminal is located right above the “Trip-Out” terminal, and should be connected to ground (earth).

In order to ensure the operating conditions of the overall system the Lens protector pins that are supplied with each Arc Slave Unit must be inserted in all light inputs that are not being used, reference sensors 0 through 9 and Trip In/Trip Out terminals.

Photo #10 ARC Slave Unit Lens protector pins

Figure #3 Falcon ARC Slave Unit
## 4.3 Falcon-CR Current Unit

### 4.3.1 Technical Specifications

| Falcon-CR current slave unit | \n|------------------------------|---|
| Auxiliary Voltage           | 12VDC |
| Power Consumption           | 1W |
| **Inputs**                  | \n| 5A, 2A and 1A               | Burden 0.25 VA |
| 1 RJ45 Data Transmission    | Auxiliary Voltage, Alarms, Self |
| Cable                       | Diagnostics |
| 1 Fibre optical cable       | Tripping Signal, to other Arc and |
|                             | Current Units and Main Units |
| **Outputs**                 | \n| 1 Fibre optical cable       | Tripping Signal, to other Arc and |
|                             | Current Units and Main Units |
| 1 RJ45 Data Transmission    | Auxiliary Voltage, Alarms, Self |
| Cable                       | Diagnostics |
| **Tripping Time**           | Less than 1 ms |
| **Display**                 | \n| 2-colour LED                | Normal Function: Slow flashing green light |
|                             | Alarm: Solid red light when pre-set |
|                             | Over Current setting value is exceeded |
|                             | Alarm: flashing red: alarm detected but |
|                             | no longer present. |
| **Over-Current Threshold**  | 50…500%*Iₙ |
| **DIP-Switches**            | To configure address of each CR unit |
|                             | See table in section 5.6 |
| **Test/Reset Green Button** | \n| Reset                       | Reset of ARC slave unit press once |
| Test                        | The Test function is operated with the same switch used for resetting the unit. Maintain the button pressed, without releasing, for at least 5 seconds. |
| **Tests**                   | \n| EN50081-1, EN50082-2        | (Compliance with the EMC standard) |
| **DNV**                     | \n| Vibration                   | According DNV No2.4 clause 3.6 Class A |
| Dry heat                    | According DNV No2.4 clause 3.7 Class B |
| Damp heat                   | According DNV No2.4 clause 3.8 Class B |
| **Operating Environment**   | \n| Operating Temperature       | 0…+70°C (32 to 158 oF) |
| Storage Temperature         | -25 to 85°C (-13 to 185 oF) |
| **Measurements**            | \n| L 16 mm. (4.56") W 105 mm. (4.13") L, 44 mm. (1.73") H |
| Weight                      | 0.9kg (2 lb.) |

*Table #3 Falcon CR Slave Unit Technical Specifications*
4.3.2 Wiring the Current Unit

The secondary outputs of current transformers are connected to terminals located on the back of the FALCON-CR unit. Each CR unit can incorporate either, 5, 2 or 1A current inputs, with a rated burden of 0.25 VA. Terminals 2-6 are designated for Phase A (L1), terminals 7-11 for Phase B (L2) and terminals 12-16 for phase C (L3). Terminal no. 1 is designated for bonding the equipment and must be connected to ground (earth).

The outgoing RJ45 data transmission cable linking the Master Unit or other CR slave units within the daisy chain are connected to the “Data-Out” port on the CR slave unit. Correspondingly, the fibre optical cable transmitting the trip signal is connected to the “Trip-Out” photo terminal on the CR slave unit.

The incoming RJ45 data transmission cable from another CR slave unit within the daisy chain (same channel), is connected to the “Data-in” port. Correspondingly, the incoming fibre optical cable will be connected to the “Trip-In” input terminal.

In order to ensure the operating conditions of the overall system the Lens protector pins that are supplied with each CR Slave Unit must be inserted in Trip In/Trip Out terminals that are not being used.

![Figure #4 Falcon CR Slave Unit](image-url)
4.4 Power Supply

4.4.1 Technical Specifications

WRA12SX

<table>
<thead>
<tr>
<th>Input</th>
<th>Input Voltage Standard</th>
<th>85…264VAC/80…350VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Optional Input Voltage</td>
<td>(19…140VDC) * Special Order</td>
</tr>
<tr>
<td></td>
<td>Frequency</td>
<td>47…440Hz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Output</th>
<th>Output Voltage</th>
<th>12VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input Power</td>
<td>25W, 2.1A</td>
</tr>
</tbody>
</table>

| Insulation | Input/Output | 3000VAC, 1min |
|            | Input/case   | 2500VAC, 1min |
|            | Output/case  | 500VAC, 1min |
|            | Input/Output/case | 50MΩ, 500VDC |

| Operating Environment | Operating Temperature | -5 to +50°C (23 to 122 oF) |
|                       | Storage Temperature   | -20 to +85°C (-4 to 185 oF) |
|                       | Relative Humidity     | 85%                            |
|                       | Vibration              | 5…10Hz 10mm, 10…50Hz 2G       |
|                       | Maximum blunt force    | 10G                            |
|                       | Measurements           | 97mm. (3.8") W*124 mm. (4.9") L*33 mm. (1.3") H |
|                       | Weight                 | 400g (0.9 lb.)                 |

Disturbance Tests: Compliance with the EMC-standard
Other Certification: UL, CSA, VDE

Table #4 Power Supply Technical Specifications

4.4.2 Power Supply Wiring

- Terminals 1 is +12 VDC
- Terminal 2 is 0 VDC
- Terminal 3, 4, and 5 are unused
- Terminal 6 is for bonding and must be connected to ground
- Terminals 7 is ACL
- Terminal 8 is ACN

Photo #11
Power Supply

Figure #5 Power Supply Terminals
5. CONFIGURING THE PROTECTION SYSTEM

5.1 General Overview.

The I-Gard Falcon Arc Protection System will be factory configured. The tripping sequence of each output relay will be based on the information provided by the client, which should include a single line diagram plus a detailed description of the power distribution system functionality, i.e. switching arrangements. A complete understanding of the system will ensure that the configuration of the I-Gard Falcon Protection System will satisfy the customer needs.

5.2 Configuration of tripping sequence

The tripping sequence of each I-GARD FALCON Protection System will be configured utilizing the information received from both the light and over-current sensing. Light detection can be based on using inputs L1 to L4 plus the dedicated 16 light inputs of the Master Unit and if applicable from other ARC slave units. Over-Current detection is based on the information received from the CR slave units. A total of four (4) solid state (t1 to t4) or five (5) electromechanical relays (r1, r2, r3, r4 and r6) can be configured based on the sequence of light and over-current detection to initiate a signal and trip a specified circuit breaker. Relay Output r5 is dedicated to trip on loss of power, under-voltage and self-diagnostics failure.

I-Gard understands that every application is unique, thus the FALCON provides the flexibility and versatility required to satisfy the requirements of the most complex power distribution designs.

5.3 Self-Diagnostics

The I-GARD-FALCON Arc Protection System provides Self Diagnostics capability. This includes the monitoring of the firmware that controls the processing of the information supplied to the Master Unit and transmitted between the Master and slave units. It ensures the healthy state of all the active system components. In case of a Self Diagnostic failure, output relay number five (r5) will alarm.
All alarms will be displayed on the front of the Main Master Unit.

As part of the system verification procedure each slave unit either Arc and or CR Current must be configured as it relates to their location in the overall system.

Each slave unit has a designated address that must be set, which enables the Main Master Unit to locate the specific slave unit either Arc or CR Current and identifies which sensor input and or current phase that has exceeded the threshold preset initiating the trip sequence command.

In order to ensure the functionality of the overall system each slave address within the designated channel D1 – D4 must be configured to ensure that the associated alarm being displayed corresponds to the specific unit. Each ARC or CR alarm indications is address dependent.

Individual addresses are set via dip switches located within each of the slave units.

Please refer to sections 5.4 for typical alarm indications and 5.8 of this manual for detailed instructions on how to configure each of the slave units.

5.4 Messages on the Master Unit Display

A Designates Arc Slave Unit

Sensor in the Arc Unit 0 to 9

Location of the Arc Unit in the Daisy Chain 1 to 6

Channel 1 to 4 Correspond to D1 to D4
LIGHT SENSORS IN THE MASTER UNIT 01 TO 16

F8 DESIGNATE THE MASTER UNIT

PHASE ("C") THAT PRESENTED THE OVER CURRENT 1 TO 3
LOCATION OF THE CURRENT UNIT IN THE DAISY CHAIN 1 TO 6
CHANNEL 1 TO 4 CORRESPOND TO D1 TO D4
C DESIGNATES CR SLAVE UNIT

LIGHT OR CURRENT ALARM ON CHANNEL L1 TO L4
ZERO (0) INDICATES AN ALARM THROUGH CHANNEL L1 TO L4
F DESIGNATES THE MASTER UNIT DISPLAY

F 0 0 4

F 8 0 5
Message on the display of the Master Unit

<table>
<thead>
<tr>
<th>Message</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Indicates that a Falcon-ARC slave unit has exceeded the activation threshold value.</td>
</tr>
<tr>
<td>C</td>
<td>Indicates that a Falcon-CR slave unit has exceeded the activation threshold value.</td>
</tr>
<tr>
<td>F</td>
<td>Indicates that a Master Unit has exceeded the activation threshold value.</td>
</tr>
<tr>
<td>e.g. A1.1.0</td>
<td>Light alarm, Channel D1, Arc slave unit 1, Light sensor input 0</td>
</tr>
<tr>
<td>e.g. F8.05</td>
<td>Light alarm, Master Unit light input 5 (numbered 1…16)</td>
</tr>
<tr>
<td>e.g. C4.6.1</td>
<td>Overcurrent alarm, Channel D4, CR unit 6, phase A</td>
</tr>
<tr>
<td>e.g. E 2.2-</td>
<td>Self -Diagnostic failure channel D2, 2nd slave unit</td>
</tr>
<tr>
<td>e.g. PP.PP</td>
<td>Power Loss outside the Protection System</td>
</tr>
<tr>
<td>e.g. F0.04</td>
<td>Alarm in Main Unit Channel D4</td>
</tr>
<tr>
<td>e.g. _10.0</td>
<td>Upon energization Master Unit displays the tripping sequence number.</td>
</tr>
</tbody>
</table>

Table #5 Message on the display of the Master Unit

5.5 I-GARD-Falcon Main Unit

The tripping sequence of each I-GARD FALCON Protection System will be configured utilizing the information received from both the light and over-current sensing. Light detection can be based on using inputs L1 to L4 plus the dedicated 16 light inputs of the Master Unit and if applicable from other ARC slave units. Over-Current detection is based on the information received from the CR slave units. A total of four (4) solid state (t1 to t4) or five (5) electromechanical relays (r1, r2, r3, r4 and r6) can be configured based on the sequence of light and over-current detection to initiate a signal and trip a specified circuit breaker.

It is recommended that the four solid state relays (t1 to t4) be utilized for the actual tripping sequence as they provide less than a 1 ms response time. The electromechanical relays can be used for alarming functionality or as secondary trip sequence of alternate breakers as a time delay can be configured for r1, r2, r3, r4 and r6.

5.6 Falcon-ARC

Each FALCON ARC slave unit will have a designated address that enables the Master Unit to identify the actual location of the ARC slave unit within the system. The address also allows the Master Unit to differentiate and identify the specific Light sensors of the corresponding ARC slave unit.
The address of each Falcon ARC slave unit is configured using the DIP switches located inside the ARC slave unit.

The pre-set address only identifies the ARC slave unit and does not affect the tripping sequence. It is meant to permit proper self-diagnostics and to assist operating personnel in locating the arc fault.

If individual addresses need to be changed the system must be in a de-energized state.

Changing the position of the DIP Switches is achieved by removing the top screws at both ends of the side covers that hold the top cover; once the top cover is removed the DIP switches are visible on the electronic board. The address is set as shown in the table below on section 5.8. When the address is set with the DIP switches, proceed to identify the unit on the outside to ensure it is positioned in the appropriate channel and in the correct sequence in the string.
5.7 Falcon-CR

Each FALCON CR slave unit will have a designated address that enables the Master Unit to identify the actual location of the CR slave unit within the system. The address also allows the Master Unit to differentiate and identify the specific Phase that exceeded the over-current activation threshold of the corresponding CR slave unit.

The address of each Falcon CR slave unit is configured using the DIP switches located inside the CR slave unit.

The pre-set address only identifies the CR slave unit and does not affect the tripping sequence. It is meant to permit proper self-diagnostics and to assist operating personnel in locating the arc fault.

If individual addresses need to be changed the system must be in a de-energized state.

Changing the position of the DIP Switches is achieved by removing the top screws at both ends of the side covers that hold the top cover; once the top cover is removed the DIP switches are visible on the electronic board. The address is set as shown in the table below on section 5.8. When the address is set with the DIP switches, proceed to identify the unit on the outside to ensure it is positioned in the appropriate channel and in the correct sequence in the string.
In addition to setting each of the addresses the user must also configure the tripping data of each CR slave unit. This task should be completed at the same time as the address set-up. With the cover removed, proceed to locate switch SW2 as indicated in the photo below.

Switch SW2 has 3 jumpers labeled pin 1, 2, and 3. If there is only one CR Slave unit connected in any of the communication channels D1 to D4 then pins 2 and 3 need to be connected with the jumper.

When more than one or multiple CR Slave units are connected in any of the communication channels D1 to D4 then pins 1 and 2 need to be connected with the jumper provided. In this configuration no Arc Slave units can be connected to the same communication channel where the current slave units are connected.
5.8 Cross - Reference table Addresses on slave units and Display messages on Master Unit.

### I-GARD-Falcon Master Unit Display

<table>
<thead>
<tr>
<th>Position of DIP switch in Units</th>
<th>1. Type of Slave unit ARC, (A) or CR, (C)</th>
<th>2. Channel (Daisy Chain) D1 to D4</th>
<th>3. Slave Unit position in the Channel (Daisy Chain) (1 to 6)</th>
<th>4. Light sensor Falcon-ARC numbered 0 to 9, Phase indication Falcon-CR A=1, B=2 and C=3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A/C</td>
<td>1.</td>
<td>1.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>2.</td>
<td>A/C</td>
<td>1.</td>
<td>2.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>3.</td>
<td>A/C</td>
<td>1.</td>
<td>3.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>4.</td>
<td>A/C</td>
<td>1.</td>
<td>4.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>5.</td>
<td>A/C</td>
<td>1.</td>
<td>5.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>6.</td>
<td>A/C</td>
<td>1.</td>
<td>6.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>7.</td>
<td>A/C</td>
<td>2.</td>
<td>1.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>8.</td>
<td>A/C</td>
<td>2.</td>
<td>2.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>9.</td>
<td>A/C</td>
<td>2.</td>
<td>3.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>10.</td>
<td>A/C</td>
<td>2.</td>
<td>4.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>11.</td>
<td>A/C</td>
<td>2.</td>
<td>5.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>12.</td>
<td>A/C</td>
<td>3.</td>
<td>1.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>13.</td>
<td>A/C</td>
<td>3.</td>
<td>2.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>14.</td>
<td>A/C</td>
<td>3.</td>
<td>3.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>15.</td>
<td>A/C</td>
<td>3.</td>
<td>4.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>16.</td>
<td>A/C</td>
<td>3.</td>
<td>5.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>17.</td>
<td>A/C</td>
<td>3.</td>
<td>6.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>18.</td>
<td>A/C</td>
<td>4.</td>
<td>1.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>19.</td>
<td>A/C</td>
<td>4.</td>
<td>2.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>20.</td>
<td>A/C</td>
<td>4.</td>
<td>3.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>21.</td>
<td>A/C</td>
<td>4.</td>
<td>4.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>22.</td>
<td>A/C</td>
<td>4.</td>
<td>5.</td>
<td>0…9/1…3</td>
</tr>
<tr>
<td>23.</td>
<td>A/C</td>
<td>4.</td>
<td>6.</td>
<td>0…9/1…3</td>
</tr>
</tbody>
</table>

Position of Dip switch: 1=ON, 0=OFF

Table #6 Cross - Reference
Addresses on slave units and Display messages on Master Unit.
5.9 Adjustment of the Light Sensitivity

When an arc flash inside one of the switchgear section occurs, the expected threshold of luminance for such an arc, is approximately 100,000 luxes (lx), the illuminance of an efficient working light is approximately 20,000 luxes (lx) the illuminance of an arc is five times larger.

The light sensitivity threshold of both the I-GARD-FALCON Master unit and the I-GARD FALCON ARC slave unit can be field adjusted to the desired level. Adjustments of the sensitivity to light are always necessary due to the changes in the illumination levels in each installation. Similarly the sensitivity to the illuminance level can be increased in the field during or after the installation to avoid nuisance light alarms or nuisance tripping.

When Falcon-ARC slave units are connected to one of the channels (D1 to D4) of the Master unit of the I-GARD FALCON Protection System, the activation threshold of the AR slave units should be adjusted first. Only after the illuminance adjustments are made in the ARC slave unit, the sensitivity to light activation threshold of the I-GARD-FALCON Master Unit may be adjusted.

The activation threshold (intensity of light) for tripping may be adjusted using the dial selector located on the cover of the ARC slave unit, or on the front panel of the Master unit. The activation threshold for light sensitivity of the master unit affects all the light inputs to that unit. In the same fashion the adjustment performed on the Arc slave unit sets the activation threshold of all the light inputs of the specific unit. The range of adjustment is from 10,000 lx to 50,000 lx.
6. INSTALLATION

6.1 Installing the Units in the Switchgear Cells

6.1.1 I-GARD-Falcon

The I-GARD-Falcon Master Unit is a flush mount type (Door mount), to allow adjustment and access to the display and alarms directly in front of the unit without opening the control cabinet of the switchgear. The Master Unit should be mounted on the door to the control cabinet of the equipment if possible or in a separate control compartment.

Prior to mounting, remove the screws holding the small holding plate on the upper back and lower back of the Master Unit.

Slide out the support posts, proceed to mount the unit through the opening on the cell door from the front.
Once the Master Unit is fitted proceed to slide back the support posts and screw back on the holding plate with the fastening screws.

Figure #6 Flush Mount surface and control cabinet dimensions
Important Note: The minimum bending radius allowed for the photoelectric cable is 25 mm (1 inch) (r = 25 mm or r = 1”). Please ensure that enough space is provided to allow for the termination of the photoelectric cable when carrying out the installation.
6.1.2 Falcon-ARC

The Falcon-ARC slave unit is designed for a DIN rail mount. It may be mounted on the back plate or on the bottom of the control cabinet by means of a DIN rail or fixed directly to the surface using 4mm machine screws, through the fixing points on the side of the unit.

6.1.3 Falcon-CR

The Falcon-CR current slave unit is designed for a DIN rail mount. It may be mounted on the back plate or on the bottom of the control cabinet by means of a DIN rail or fixed directly to the cabinet using 4mm machine screws, through the fixing points on the side of the unit.

6.2 Installing the Photoelectric Cable

6.2.1 General Overview

The photoelectric cable used in the I-GARD-FALCON Arc Protection System has been particularly developed for data transmission applications. The cable is a single-fiber type with a polyethylene outer layer to endure exposure to severe operating environments. The cable installation does not require any kind of protection equipment or special tools.
**6.2.2 Preparing of Cable Ends**

The preparation of the photoelectric cables used in the I-GARD-FALCON Arc Protection System is simple. Proceed to measure the length of the cable run between the Light Sensor and the light input terminal on either the ARC slave unit or on the Master Unit. All the measurements inside the cells or compartment of the switchgear must be taken with the switchgear DE-ENERGIZED.

Note that the photoelectric cables of the I-GARD-FALCON Arc Protection System can be ordered pre-cut according to the measurements provided by the customer and ready for installation. This is particularly helpful for retrofitting existing in-service switchgear.

The following tools and accessories are required for the preparation of a photoelectric cable:

- the Hewlett Packard HFBR-4593 Grinding Kit including
  - polishing fixture
  - 600 grid abrasive paper
  - polishing paper
- Wire strippers and wire cutters
1.- Proceed to cut the cable to the length measures using the wire cutter and Stripper (available as an accessory).

2.- Strip 5mm. off the end of the cable that will be connected to the Arc or to the Main Unit.

3.- Insert the end of the cable into the polishing fixture, then proceed to grind the end of the cable on the abrasive paper (#600) grinding the end of the fibre until fairly smooth. The end of the fibre does not need to be ground evenly down to the bottom of the fixture, but it is important to grind the end to a flat surface perpendicular to the length of the fibre.

Photo #32 Inserting the end of the cable into the polishing fixture
4.-With the cable end in the polishing fixture, proceed to polish using the polishing paper until a smooth surface is obtained.

![Photo # 33 Polishing the cable with the polishing paper](image1)

5.-The fibre end shall be smooth and clean, prior to terminating the fibre in a light input terminal on the Arc slave unit or on the Master Unit.

6.- Insert the cable end into the photo input pushing it gently as far as possible (approx. 15 mm (9/16”)) and tighten the connector to fix the cable.

![Photos # 34 and 35 Inserting Fiber Optic into the Light input of Master Unit](image2)
6.2.3 Photoelectric Cable Triplexer

The photoelectric cable triplexer is meant to be used in situations where the standard number of light detection points is not sufficient and it is desirable to protect each section of the equipment independently.

With the photoelectric cable triplexer a total of 3 light sensors are available with a single output feed being interconnected to either a light input of an Arc Unit or the Main Master Unit. Each of the 3 light sensors can be installed in the same section or in other sections of the line-up.

The photoelectric cable triplexer may be DIN rail mounted, or fixed directly to the enclosure surface with the 4mm machine screws provided. Locating the triplexer closer to the detection points will save on cabling time and cost as only one photoelectric cable from the triplexer is run to either the I-GARD-Falcon Master Unit or the Falcon-ARC slave unit.

The Cable triplexer filters the total amount of light that passes through the light inputs in the triplexer with no adverse effect on the operating reliability of the I-GARD-FALCON Arc Protection System.

Please refer to the drawing below that shows a typical wiring diagram of Cable Triplxers inside the switchgear.

Figure #8 Typical wiring diagram of Cable triplxers inside the switchgear
6.2.4 Extending of the Photoelectric Cable

The photoelectric cable may be extended using an HFBR-4505 connector. Extensions may be necessary when the cable is damaged during installation, or the photoelectric cable is damaged after an Arc inside a cell. In such cases, only the damaged section of the cable is removed and replaced with an extension.

No special tools are necessary when extending the photoelectric cable with a connector. The cable ends need to be prepared in the same way as the described in section 6.2.2.

Extending the cable with a connector reduces the amount of light passing through the junction by 8%, while this does not affect the operating reliability of the I-GARD-FALCON Arc Protection System, we recommend to keep the number of extensions to a minimum.

When extending the length of the photoelectric cable, please avoid extending a single run of photoelectric cable beyond 100m (330 feet). This will ensure that the system is operating to design limits and that you are receiving maximum reliability.

6.2.5 General Information on the Filtered Light Sensor

The light sensor expands the protected area to a wider area than that which may be covered by the cable end alone. The sensor does not have any moving or live parts, is easy to install, service free and extremely reliable.

This sensitivity level is lightly affected by the light sensor and the length of the photoelectric cable. The sensitivity range can be adjusted between 10,000 to 50,000 luxes (10klx.to 50klx) The measurements shown below were obtained using a 25m photoelectric cable, a 1000W working light and Camera flash in an open environment where the surrounding light was E=300lx.
6.2.6 Preparing the Light Sensor Cable End

The preparation of the photoelectric cables used in the I-GARD-FALCON Arc Protection System is simple. Proceed to measure the length of the cable run between the Light Sensor and the light input terminal on the ARC slave unit or on the Master Unit. All the measurements inside the cells or compartment of the switchgear must be taken with the switchgear DE-ENERGIZED.

Note that the photoelectric cables of the I-GARD-FALCON Arc Protection System can be ordered pre-cut according to the measurements provided by the customer and ready for installation. This is particularly helpful for retrofitting existing in-service switchgear.

The following tools and accessories are required for the preparation of a photoelectric cable:
- the Hewlett Packard HFBR-4593 Grinding Kit including
  - polishing fixture
  - 600 grid abrasive paper
  - polishing paper
- Wire strippers and wire cutters
1.- Proceed to cut the cable to the length measures using the wire cutter and Stripper (available as an accessory).
2.- Strip 3mm. off the end of the cable that will be connected to the Arc or to the Main Unit.
3.- Insert the end the cable into the polishing fixture, then proceed to grind the end of the cable on the abrasive paper (#600) grinding the end of the fibre until fairly smooth. The end of the fibre does not need to be ground evenly down to the bottom of the fixture, but it is important to grind the end to a flat surface perpendicular to the length of the fibre.
4.- With the cable end in the polishing fixture, proceed to polish using the polishing paper until a smooth surface is obtained.
5.- The fibre end shall be smooth and clean, prior to terminating the fibre in a light input terminal on the Arc slave unit or on the Master Unit.

6.- Insert the cable end into the light sensor pushing it gently as far as possible (approx. 15 mm (9/16\”) and crimp the metal ring to fix the photoelectric cable.

The photoelectric cable is now ready to be installed in the switchgear to be Arc protected.

6.2.7 Installing of the Sensor in the Switchgear

Light sensors are installed inside the electrical equipment where they can detect light from an arc that would occur in the area being protected. The sensor does not need to point directly to the bus-bar or the breaker as the sensor detection range has a circular shape. In open bus-bar compartments the sensors shall be located at 6 to 7 meter (18 to 22 feet) intervals to reach an optimum level of protection.

Photo #37 Inserting the cable end into the light sensor

Photo #38 Crimping the metal ring to fix the cable

Photo #39 Light sensor mounted on a bracket.

Photos # 40 and 41 Securing the light sensor on the bracket.
It is recommended that for medium voltage applications that individual light sensor be installed within each of the compartments. In the low voltage section, at least the busbar compartments and the supply circuit breaker compartments should have an individual light sensor to be properly protected. If there is a need to protect all the cells in a low voltage line-up, we recommend using a photoelectric cable triplexer.

6.3 DATA CABLE

6.3.1 General Overview

The RJ45 data transmission cable is a twisted pair, shielded type cable, rated for data transmission. The cable shielding prevents external electromagnetic interference and complies with the ISO/IEC IS 11 801 and the EN 50173 standards.

It is not recommended to extend the run of RJ45 data cable beyond 100 m (330 Feet) between individual Arc and or Current units or between individual Arc and or Current Unit and the Main Master Unit. Cable Runs longer than 100 m (330') runs will compromise the reliability and tripping speed of the I-GARD-FALCON Arc Protection System.

6.3.2 Functions of the RJ45 Data Transmission Cable

The RJ45 data transmission cable is used in the I-GARD-FALCON Arc Protection System to transmit alarm and self diagnostics data between the slave units either Current CR or ARC and the Main Master Unit. Communication signals and Auxiliary input voltage for both Arc and or Current units is also transmitted through the same cable. The Trip command sequence is transmitted via the photoelectric cable, to ensure the maximum speed for tripping and to avoid nuisance tripping.
6.3.3 Preparing of the Ends of the Data Transmission Cable

The data transmission cables may be ordered pre-cut according to measurements supplied by the client, or they can be prepared at the site.

The following tools are needed to prepare a data transmission cable:

- Clamping pliers: HT-2008R
- Stripping cutter: AMP-525421-8
- Connector: RJ-45SH

1. Cut the right length of cable using the cutting side of the clamping pliers.
2. Push the cable through the stripping cutter and strip 10 mm. of the outer jacket at each of the ends of the cable.
3. Spread out the conductors in the cable, aligning them in the sequence in accordance to the table below. Once aligned in the proper order, gently push them into the connector as deep as possible (approx. 20 mm (3/4’’)). Before clamping the connector, make sure the conductors are in the right order by colour and that the shield conductor is pressed against the earth strips in the connector.
4. Clamp with clamping pliers.

<table>
<thead>
<tr>
<th>Color</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown (1st pair)</td>
<td>connector 1</td>
</tr>
<tr>
<td>White, brown stripe (1st pair)</td>
<td>connector 2</td>
</tr>
<tr>
<td>Orange (2nd pair)</td>
<td>connector 3</td>
</tr>
<tr>
<td>White, orange stripe (2nd pair)</td>
<td>connector 4</td>
</tr>
<tr>
<td>Blue (3rd pair)</td>
<td>connector 5</td>
</tr>
<tr>
<td>White, blue stripe (3rd pair)</td>
<td>connector 6</td>
</tr>
<tr>
<td>Green (4th pair)</td>
<td>connector 7</td>
</tr>
<tr>
<td>White, green stripe (4th pair)</td>
<td>connector 8</td>
</tr>
</tbody>
</table>

For more information, please contact I-Gard Corporation

Table # 8 Aligning sequence.

![Diagram of Connectors](image-url)
6.3.4 Connecting the Data Transmission Cable to the Units

The RJ45 data transmission cables are connected to the input and output connectors of the different (Arc or Current) slave units. Both Current and ARC slave units may be daisy-chained (connected in series) on the same channel so that the outgoing cable from the previous ARC and or Current slave unit is connected to the input connector of the next unit within the daisy chain. The data transmission cable from the first unit in the daisy chain either Current or Arc will be connected to the Main Master Unit, channel D1 – D4.

Please refer to figure #1 (falcon Connections).

7. TRIPPING INFORMATION

Both the solid state electromechanical output relays can be configured to satisfy any tripping sequence that is required.

It is recommended that the primary tripping signal will be transmitted utilizing the solid state output, which initiates the trip command in less than 1msec. As the electromechanical relays have a longer tripping sequence time they should be used for alarming only or in a back-up protection scheme.

The flexibility of the I-Gard Arc Protection System enables you to initiate a trip command via the solid state output relays to a maximum of four, (4), breakers per system. This is most commonly used in Main/Tie/Main or Redundancy Switching application schemes.
As mentioned, the Six, (6), electromechanical relays are recommended for alarming or backup protection only as the trip command sequence is approximately 8 – 10msec.

It is also recommended that since the solid state relays only provide for a momentary output that the electromechanical relays are used to latch the output. This ensures that trip sequence has to be investigated on site before the electrical service is put back into operation. The resetting of the system is via the “reset” pushbutton located beside the Master Unit.

8. TESTING OF THE SYSTEM

The testing of the entire I-GARD FALCON Arc Protection Systems needs to be commissioned only after the installation of the system is complete.

As both light detection and over current sensing is used to initiate the trip command sequence all system components need to be verified.

Depending on the number of light sensors connected to the Main Master Unit the test procedure will be the same. Each of the sensors will be connected to either light receiver numbered 1 through 16 and/or L1 through L4. It is recommended that a high intensity light similar to a camera flash is used. In close proximity to the actual light sensor initiate a flash. If the systems does not alarm then reduce the threshold sensitivity on the front of the Main Master Unit and repeat the procedure. Once an alarm is initiated please view the front of the Master Unit for the corresponding alarm display. Please refer to Section 5.4 for alarm details. The resetting of the Main Master Unit will be achieved by pressing the reset button once for each alarm that was initiated.

Each of the ARC slave units installed within the system needs to be tested. This is achieved in the same manner as the Main Master Unit. A total of 10 light sensors can be connected to each Arc Unit and will be connected to light receivers 0 through 9. It is recommended that a high intensity camera flash be used. In close proximity to each sensor initiate a flash. Again if the system does not alarm then reduce the threshold sensitivity on the front of the Arc Salve Unit. Once an alarm is initiated, which will be indicated by the solid LED green light changing to red please review the front of the Main Master Unit for the corresponding
alarm display. Please refer to Section 5.4 for alarm details. The resetting of the Arc Unit will be achieved by pressing the test button once, upon resetting the LED light changes back to green.

The Current CR Unit can be tested either by pressing and holding the reset button in for approximately 5 seconds or by current injection directly into the Current transformer inputs. In either case an alarm will be initiated, which will be indicated by the solid LED green light changing to red please review the front of the Main Master Unit for the corresponding alarm display. Please refer to Section 5.4 for alarm details. The resetting of the CR Unit will be achieved by pressing the test button once, upon resetting the LED light changes back to green.

Please note that the alarms for either Arc or Current Slave Units can also be reset by pressing the Reset button once for each alarm indicated on the front display. The Reset button is located on the front of the Master Unit.

9. CE-CERTIFICATION / ISO-9001

The entire system has passed the tests required by the EMC standard and it has been accredited with the CE certification. The quality of the Protection System is guaranteed by certification in compliance with the ISO-9001.

10. DNV-TESTS

The whole system has been tested according DNV requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN50081-1, EN50082-2</td>
<td>(Compliance with the EMC-Standard)</td>
</tr>
<tr>
<td>Vibration</td>
<td>According DNV No2.4 clause 3.6 Class A</td>
</tr>
<tr>
<td>Dry heat</td>
<td>According DNV No2.4 clause 3.7 Class B</td>
</tr>
<tr>
<td>Damp heat</td>
<td>According DNV No2.4 clause 3.8 Class B</td>
</tr>
</tbody>
</table>
11. APPLICATIONS EXAMPLES
These are some of the I-Gard Products. For more information or for a complete list of them, please contact I-Gard

FALCON
Optical Arc Protection System

VIA
Voltage Alarm Indicator

mGARD
Ground Fault Relay

STOPLIGHT
High Resistance Grounding System

GEMINI
High Resistance Grounding System

SLEUTH
High Resistance Grounding System

FUSION
High Resistance Grounding System

SENTINEL
High Resistance Grounding System

MGFR
Ground Fault Relay

DSP OHMNI
High Resistance Grounding System

SIGMA
Ground Fault Relay Resistor Monitor

GCHK-100
Mining Relay