Technical Note

ILX56-MM Redundant ProSoft Tested

Document Code: TN2009_ILX56-MM_Redundant_Tested
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Overview

Introduction
This document and matching ladder provide a template of how to setup the ILX56-MM for applications requiring redundant modules. The example ladder checks the health of the ILX56-MMs, selects the valid ILX56-MM transfer data to be used by the ControlLogix program and supplies diagnostic tags. This example uses two ILX56-MMs in the same rack as the ControlLogix processor. This code will support using two ILX56-MMs in separate remote racks. The RSLogix 5000 project would have to be modified to add the ILX56-MMs in their respective remote racks and modify the ladder to point to the new module addresses. This example has data transferring to a ControlLogix from: a SLC 5/05 through a 1756-ENBT, a Siemens S7 controller through the ILX56-MM’s on board Ethernet port, and a ProSoft Modbus TCP/IP gateway through the ILX56-MM’s on board Ethernet port. This same method would need to be used for all ILX56-MM data transfers.
Configuration Option

Trigger options:

The ladder supports a number of different redundant operation modes depending on the trigger mode configured in the ILX56-MMs using Internet Explorer.

1) Always
This option has both ILX56-MM modules continually running and talking to the devices in their lists. The ladder will only use data from one module but will switch over to the other module in the event of a failure. This will have the fastest switchover time but will use twice as much network bandwidth and PAC/PLC communication resources. The code is used only to monitor module status and communication errors.

2) Change
This option has only one ILX56-MM module communicating to the PAC/PLCs at a time. The code will cause a switch over on an ILX56-MM failure or if the ILX56-MM is placed in “Idle” mode. All transfers will stop if the ControlLogix is not in “Run” mode. The tags “ILX_MM_1_On_Change” and “ILX_MM_2_On_Change” are used for this option.
3) Equal
This option has only one ILX56-MM module communicating to the PAC/PLCs at a time based on the tag “ILX_MM_Active”. The code will cause a switch over on an ILX56-MM failure or if the ILX56-MM is placed in “Idle” mode. This has the ILX56-MM transferring data even when the ControlLogix is in the “Program” mode.

Example ILX56-MM “Always’ Option Trigger configuration

![Example ILX56-MM “Always’ Option Trigger configuration]

Example ILX56-MM “Change” Option Trigger configuration

![Example ILX56-MM “Change” Option Trigger configuration]
Example ILX56-MM “Equal” Option Trigger configuration

![Trigger Configuration Diagram](image)

**SETUP**

Sample ladder, ProSoft_ILX56_MM_Redundancy_RevB1.ACD V17, has been developed to assist in using two ILX56-MMs in a redundant mode (primary, secondary). This code needs to be added to your ControlLogix application code and modified to point to your ILX56-MM I/O locations. The ILX56-MM firmware must be Version 1.06 (P0330_093 P: v1.00) or later.

The Sample ladder supplies several diagnostic features including an ILX_MM_1.Failure or ILX_MM_2.Failure flag, a counter of how many swaps occurred, an ILX_MM_1.Error bit to identify an error from any device not communicating to the ILX56-MM and which ILX56-MM is being used. It also contains a Date Time record of the first 10 times the swaps occurred for each module.

The optional Start_Reset Ladder is used to initialize the diagnostic registers. This can be triggered from the main routine by toggling the Main_Start_reset bit.

Configure the first ILX56-MM using Internet Explorer including the data transfers you require using the Trigger option you select. Back-up the ILX56-MM configuration and then restore it to the second ILX56-MM. The Ethernet IP address(s) will need to be changed. The trigger will need to be pointed to the appropriate tag if the “Change” trigger option is used.

Put the ILX56-MMs in the “Run” mode and then put the ControlLogix in the “Run” mode and then test your system.
Example ILX56-MM Configuration showing the Modbus TCP/IP Transfer

Example code ControlLogix Controller Tags

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Data Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLXFAIL_counts_1</td>
<td>INT</td>
<td></td>
<td>Used to limit how many times this value is saved.</td>
</tr>
<tr>
<td>FLXFAIL_counts_2</td>
<td>INT</td>
<td></td>
<td>Used to limit how many times this value is saved.</td>
</tr>
<tr>
<td>Example_1</td>
<td>COUNTER</td>
<td></td>
<td>How many times the module has stopped since last time manually set to 0.</td>
</tr>
<tr>
<td>Example_2</td>
<td>COUNTER</td>
<td></td>
<td>How many times the module has stopped since last time manually set to 0.</td>
</tr>
<tr>
<td>ILX_WM_1</td>
<td></td>
<td>BOOL</td>
<td>ILX554M Status BIT</td>
</tr>
<tr>
<td>ILX_WM_2</td>
<td></td>
<td>INT</td>
<td>Which ILX554M is being used.</td>
</tr>
<tr>
<td>Keep_time</td>
<td>TIMER</td>
<td></td>
<td>ILX554M network connection timeout.</td>
</tr>
<tr>
<td>Local3C</td>
<td></td>
<td>BOOL</td>
<td>Local 3C</td>
</tr>
<tr>
<td>Local3D</td>
<td></td>
<td>BOOL</td>
<td>Local 3D</td>
</tr>
<tr>
<td>Local3SC</td>
<td></td>
<td>BOOL</td>
<td>Local 3SC</td>
</tr>
<tr>
<td>Local3SC_0</td>
<td></td>
<td>BOOL</td>
<td>Local 3SC</td>
</tr>
<tr>
<td>Local3SC_1</td>
<td></td>
<td>BOOL</td>
<td>Local 3SC_1</td>
</tr>
<tr>
<td>MainStart_event</td>
<td></td>
<td>BOOL</td>
<td>Main Start event used to clear all failures, wait stack times, and make sure ILX554M is in Run mode.</td>
</tr>
<tr>
<td>Modbus_Data</td>
<td>INT</td>
<td>INT16</td>
<td>Tags for Modbus TCP/IP device.</td>
</tr>
<tr>
<td>S7_data</td>
<td>INT</td>
<td>INT16</td>
<td>Tags for Siemens device.</td>
</tr>
<tr>
<td>PLC_data</td>
<td>INT</td>
<td>INT16</td>
<td>Tags for PLC data.</td>
</tr>
<tr>
<td>Start_counter</td>
<td>INT</td>
<td></td>
<td>Create a changing value to allow the ladder to run on the slave modules for Start/Reset ladder.</td>
</tr>
<tr>
<td>Time_out_ILX3</td>
<td>INT</td>
<td>INT16</td>
<td>Wall Clock Time Last 10 times logic switch away from ILX3.</td>
</tr>
<tr>
<td>Time_out_ILX2</td>
<td>INT</td>
<td>INT16</td>
<td>Wall Clock Time Last 10 times logic switch away from ILX2.</td>
</tr>
</tbody>
</table>
Tag Descriptions: (x = ILX56-MM 1 or 2)

- **Ex_Failure_countx_les_10:** Used to limit how many wall clock values are saved. First 10 ILXx
- **Example_Failure_count_x:** How many times the module has swapped since last time manually set to 0
- **ILX_Main_timer:** How often to check the health of the ILX56-MMs
- **ILX_MM_x:**
  - **Activity_counter:** ILX56-MM free running counter
  - **Activity_counter_old:** Shows last value of Activity Counter
  - **On_Change:** Checks to make sure the PAC/PLC is in run mode as well as which ILX56-MM should be polling the PAC/PLCs
  - **Switch:** This bit forces a switch over when the ILXx has failed
  - **RunMode_In:** 1 = Module in Run Mode
  - **IdleMode_in:** 1 = Idle Mode
  - **Mode_out:**
    - 1 = IdleMode
    - 2 = RunMode
    Requires change in Mode_change to make take effect
  - **Mode_change:** Change makes Mode_out take effect
  - **Error:** 1 = Port Error in ILX
  - **Failure:** Problem occurred for Error_timer duration
  - **Active:** Which ILX is being used.
- **Main_Start_reset:** Used to clear all failures, wall clock times, and make sure ILX's are in Run mode
- **Modbus_Data:** Data Received from ILX56-MMs
- **S7_ints:** Data Received from ILX56-MMs
- **SLC_data:** Data Received from ILX56-MMs
- **Start_counter:** Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- **Time_of_ILXx_last_fail:** Wall Clock Time Last 10 times logic switch away from ILXx

**Timing Considerations**

This test case the data exchange is setup for 100 ms triggering. It took 40 ms average (36-59 ms range) for the 100 Modbus Integers to get transferred.

**For every command to a specific IP address (end device) all transfers should be added together to determine the fastest trigger speed. Separate IP addresses will have separate connections so use the longest one device being communicated too, plus some overhead safety time. The RPI of the ILX56-MM's is set to 25 ms in this example. More than two RPI cycles are required to monitor a change in the free running timer of the ILX56-MM. This example uses 150 ms for the main timer preset value and is the minimum setting. You may need to increase this value if you ILX56-MM are in remote racks from the ControlLogix processor.**

Setting the Trigger poll rate faster than a transfer’s “Exe Max” should NOT be done.
ILX56-MM Trigger Status

<table>
<thead>
<tr>
<th>Trigger Name</th>
<th>Count</th>
<th>Error</th>
<th>Exec Average (mSec)</th>
<th>Exec Min (mSec)</th>
<th>Exec Max (mSec)</th>
<th>Cycle Average (mSec)</th>
<th>Cycle Min (mSec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All_transfers</td>
<td>742,817</td>
<td>1</td>
<td>49</td>
<td>37</td>
<td>92</td>
<td>100</td>
<td>91</td>
</tr>
</tbody>
</table>

Generic Profile Configuration

This is how the information is used:

- CLX Output DINT[0] is the command trigger (CmdTrigger)
  - Increment (or change) this in ladder to execute the command contained in DINT[1].
- CLX Output DINT[1] is the command (Cmd).
  - Currently supported commands values are:
    1=Go to IdleMode
    2=Go to RunMode
- CLX Input DINT[0] is status information.
  - Bit[0] = IdleMode indicator
  - Bit[1] = RunMode indicator
  - Bit[2] = ActiveError indicator
- CLX Input DINT[1] is a FreeRunCounter.
RPI should not be less than 25.0 ms

Code to copy ILX56-MMs Status data to named Controller Tags
Code to set how often to check the ILX56-MM’s health

Code that checks which ILX56-MM is healthy and is running
Code that counts failures and time date stamps the event
Code used for PAC setting ILX56-MM to Run or Idle mode

If ILX1 is not in run mode and a change request is done to put it into run mode it is sent:

```
LEQ
Source A: Local 3 (Data)
Source B: ILX_MM1_Mode_out
```

```
MOV
Source: ILX_MM1_Mode_out
Dest: Local 3 (Data)
```

If ILX2 is not in run mode and a change request is done to put it into run mode it is sent:

```
LEQ
Source A: Local 5 (Data)
Source B: ILX_MM2_Mode_out
```

```
MOV
Source: ILX_MM2_Mode_out
Dest: Local 5 (Data)
```
Optional:

Start Reset Ladder code
Makes sure the ILX56-MMs are in run mode, resets counters in ladder, and clears time stamp history in the controller tags

Start_Reset_ladder

Example_Failure_count_1

Example_Failure_count_2

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
- Source B Start_counter
- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
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How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
- Add Source A
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- Dest Start_counter

ILX56-MM Status LDT
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- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

Note:

Start Reset Ladder code

- Creates a changing value to allow the ladder to turn on the run modes for Start_Reset ladder
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- Dest Start_counter

ILX56-MM Status LDT
- ILX56_M2_Failure
- ILX56-MM Status LDT
- ILX_M1_Failure

How many times the module has swapped since last time manually set to 0
Example_Failure_count_1

How many times the module has swapped since last time manually set to 0
Example_Failure_count_2

Used to link how many values are saved. First 10 ILX1

MOV

Source

Dest Example_Failure_count_1

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