PROFIBUS DP Actuator Option Card. Guide for use with Mitsubishi Qn series PLC's with Profibus master module.

Publication S421E V1.0
Date of issue: 03/05

Introduction.

This guide details the necessary settings and procedures required to establish Networked communications between a Rotork Actuator and a Mitsubishi Qn PLC using Profibus DP.

This document relates to the Profibus module as applied to an IQ, IQT or Q series valve actuator.

Equipment, Information and Software required.

This guide assumes that a degree of knowledge is present with regard to the configuration of the Mitsubishi PLC where the rack layout and module addressing is concerned.

The setup will require the following.

Rotork Profibus DP - Mk2 module. Three variants are available with single and dual connection capability.

Rotork Profibus DP – Mk2 module installation manual. Publication S420E Version 3.

Rotork GSD files:-
RTRK0845.gsd (Single channel).
RTRC0845.gsd (Simple dual channel).
RTRR0845.gsd (Dual channel, REDCOM).

Mitsubishi Qn PLC CPU complete with a power supply unit, rack and QJ71PB92D Profibus master module.

Mitsubishi QC30 – RS232 programming cable.
Mitsubishi Profibus system configuration software 'GX Configurator DP' version 6.01.

Mitsubishi PLC system configuration software 'GX IEC Developer' version 6.01.
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Profibus approved cable with 'D' type terminations.

Profibus Master Module installation.

The Profibus master module should be mounted into the PLC rack in accordance with the manufacturer's instructions paying particular attention to grounding and termination.
It is necessary to identify the address of the master module as dictated by the position on the PLC rack and the slot location. This information can be obtained by using the 'System Monitor' utility contained in the GX IEC application.

Preparing GX Configurator DP.

In order to correctly parameterise the master module for use with the Rotork interface card, the appropriate GSD files must be made available to the configuration software. GSD files are added to the application using the [Setup utility] [GSD Device-database] management dialogue shown in figure 1.

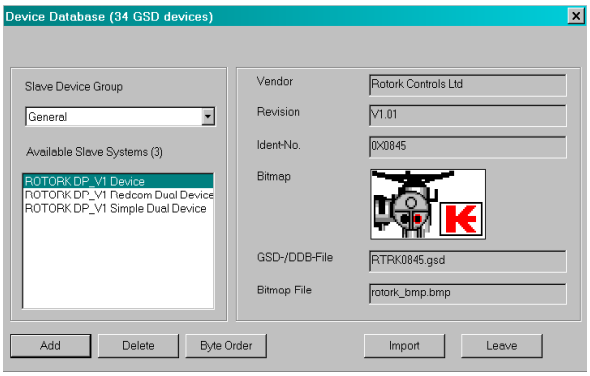

Figure 1. Dialogue for adding GSD files to GX Configurator DP.

Configuring the network.

Master Module type.

After selecting [NEW] from the file menu the type of master module is selected from a list box. The master module QJ71PB92D should be selected using either mode 0 (32 byte mode) or mode E (extended mode). Mode E is preferred if the IEC 61131 editor is being used. Please refer to the QJ71PB92D manual for a system description.

After selection of the master module the display changes to the network display.

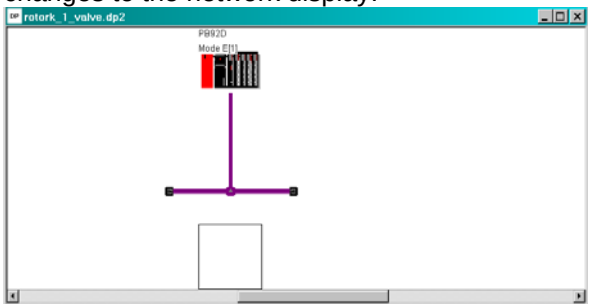

Figure 2. Network display.

Slaves are added to the network by using the right mouse button and making the 'Insert DP Slave' selection.
The available slave database is displayed from which the required Rotork device can be chosen depending on the Profibus interface card fitted in the actuator and the desired control functionality.

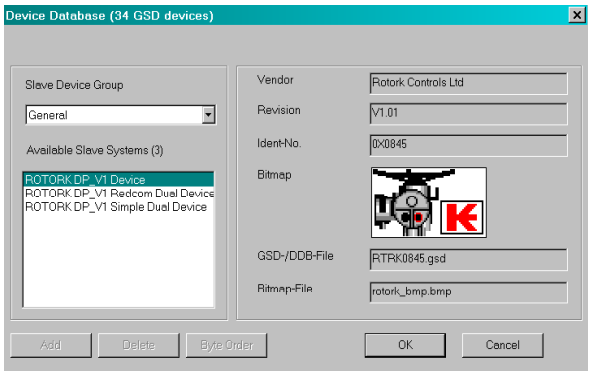

Figure 3. Slave settings.

When a Slave is selected the following data entry screen is shown.

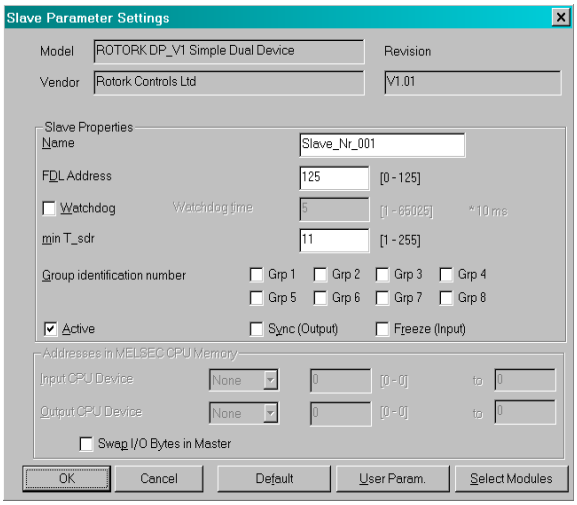

Figure. 4. Slave settings.

The following settings are required to be input.

Name: The name of the slave can be chosen for documentation purposes only.

FDL Address: Field device list address which can be chosen in the range from 0 to 125. Address 0 should be avoided if possible.

Watchdog: **<u>This function must be enabled</u>**. This function will cause the slave to monitor the status of communications with the master. Should the watchdog time out, the slave will appear as a new node when comms are restored allowing it to be returned to the network by the master module.

Watchdog time: The time interval to be used with the watchdog. This may need to be adjusted depending on the speed of the Bus. **<u>The time should never be set to zero</u>**. The Data Control Time in the Master should be at least six times longer than this watchdog time.

Active: Determines if the slave is physically connected or will be added at a later time.

Select Modules Button: The slave dialogue allows the selection of one configuration module from ten modules each offering a variation in the type and amount of data that can be accessed from and sent to the Actuator. We recommend that config. 1 be used in the first instance.

Addresses in Melsec CPU Memory:
The data being transmitted across the network between the master module and the slaves is resident inside the master module. To access this data, devices must be allocated in the PLC which mirror this and can be utilised in the user program.
Input devices receive data FROM the network while output devices SEND data to the network.

Swap I/O Bytes in the Master:
This should **always** be set by clicking with the left mouse button. The actuator presents its' data in word format while the master module exchanges data with the actuator in bytes. Due to this method of data exchange the upper and lower bytes will be swapped unless this feature is used.

<u>Other parameters should not be changed without reference to the master module manual.</u>

When the slaves have been added to the network the master module settings should be made. Double clicking on the master module icon will
open the settings dialogue. See figure 5.

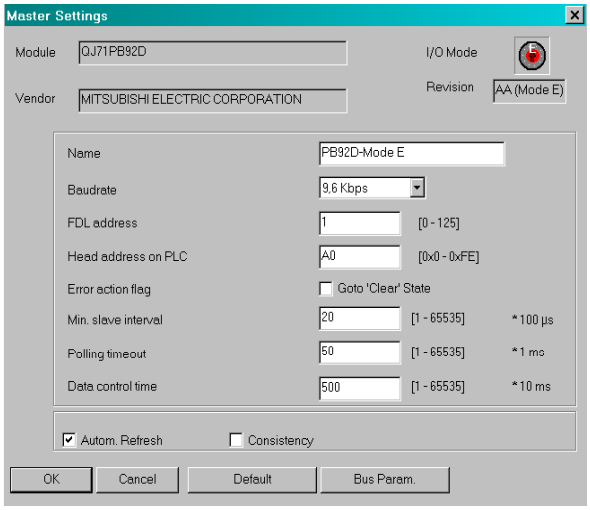

Figure 5. Master module settings.

The master module will default to the settings shown in figure 5. Changing the baud rate will **NOT** adjust the timing settings automatically.

Where required settings should be made as follows:

Name: This is an optional setting and defaults to the module name in use.

Baud rate: Determines the speed of the data communications which is directly related to the length of the Bus length. For guidance on the physical construction of the network refer to the Rotork publication S420E V3.0.

FDL address: A unique field address identifier in the range 0 – 125. Station 0 should be avoided.

Head Address on PLC: This represents the position of the master module in input/output addressing terms and is wholly dependant on other modules installed in the PLC rack. For confirmation of the rack addressing the System Monitor utility can be used in GX IEC developer.

Error Action Flag: If used this will cause all Actuator outputs to be turned off in the event of a network error.

Data Control Time: This defines the period in which the master module will decide if a slave is no longer communicating on the network. It has a direct relationship with the slave watchdog time and should be set to a value six times the shortest slave watchdog time.

Autom. Refresh: This determines if the PLC and master module will exchange data with each other under the control of a user program or automatically. The type of devices on the network and control methods required will determine if this option can be used. It is a global setting for all slaves.

If Autom. Refresh is not enabled the "Create POU" facility can be used to automatically make a POU for import into a GX IEC developer project.

It is recommended that no changes be made to the "Bus Param" settings without reference to the Mitsubishi master module manual. Serious failure of the network may otherwise occur.

The figure below shows a configured project with one Actuator. The user configured node address in this case is [5] with a slave tag of 'Actuator_5'. The master module organises the exchange of data with the network using this logical node address.

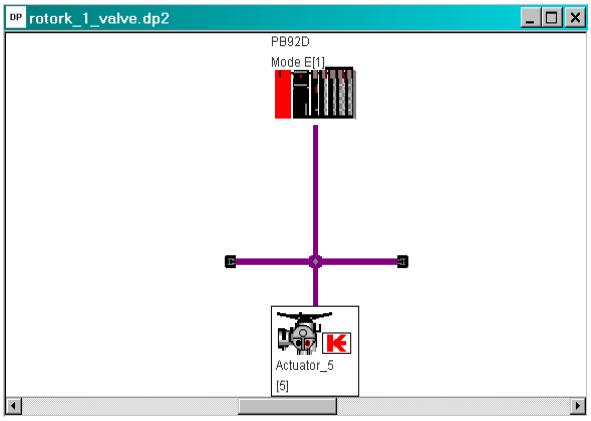

Figure 6. Network with one node.

Caution. It is recommended that nodes are addressed sequentially with no gaps. As there is a direct relationship between the node address and the location of the data mapped to the master module input/output image area, adding nodes at a later stage with addresses **between** existing nodes will change the location of the data for **ALL** devices after the new node. The PLC will therefore receive incorrect information requiring that the user program be changed.

Downloading the Project to the master module.

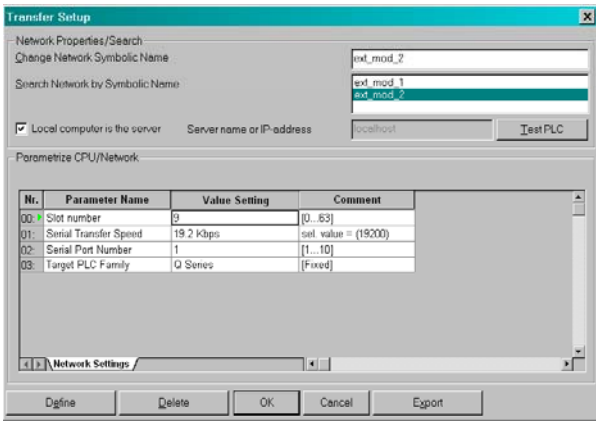

Figure 7. Transfer setup screen.

Figure 7. shows the transfer settings dialogue for GX Configurator DP. Multiple connection paths can be configured to send a project to more than one master module. This allows parameterisation of redundant systems or duplicate networks to be easily made. It should be noted that it is the physical slot number occupied by the module, in this case slot number 9, which is required in this setup. Where a PLC system with a multiple rack configuration is concerned, the slots are counted from the right of the CPU starting with Slot 0. See below.

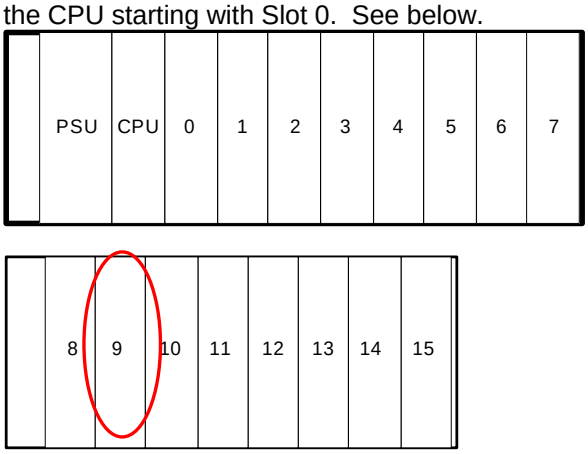

Figure 8. Slot configuration – Qn PLC.

Connection to the master module is achieved through the PLC CPU programming port using either RS232 or USB (Q02H or higher).

After testing the PLC communications, the project can be downloaded to the master module after which the network can be started manually from the dialogue box then showing.

Configuration, parameterisation and data linking will take place.
NOTE. Performing a reset at the PLC CPU will cause the master module to restart the network and re-configure and re-parameterise all slaves.

Variations in Configuration including System and Flying Redundancy.

System Redundancy.
This configuration provides two separate data highway connections to an Actuator, each being controlled by a master module.

Using Simple or Redcom dual interfaces an identical configuration can be used in each of the Bus masters. This is allowable as both channels of the network assume the same node address.

In the SR mode, when the card is powered 'on', Channel 1 will be the Primary channel. If the card does not enter Configuration Mode within 2 seconds (because there is no master present) then Channel 2 will take over as Primary, now if there is no communication within 4 seconds, then it will revert to Channel 1 and now it will wait 8 seconds before Channel 2 assumes Primary status. The switch over time will increase by a factor of 2 each time until it reaches its maximum of 32 seconds. It will continue to switch channels using a 32 second switch over time until one channel receives PLC messages.

In the event of a failure of the Primary channel the Backup automatically changes to become Primary and communication will be established with the Second master on the second highway. The Backup channel can be used for exchanging data but any commands to move the actuator directed to the backup channel will be ignored. If a configuration message is sent to the Backup channel that is different to the one sent to the Primary it will be accepted but not acted upon. The data exchanged between the master and the Primary includes information on the status of the device and hence the availability of a Backup should the Primary fail.

Flying Redundancy.
This provides a single physical data highway connected to both channels of a Profibus dual interface using a similar configuration in each of **TWO** Bus masters. The master modules must have different addresses.

A slave node is configured for both ports of the interface, an offset of 64 between each address. For example, an actuator with a Primary slave address of 5 will require the secondary port address to be 69.

It must be remembered that this limits the maximum device address to 61 since the second port address will need to be less than 126 (61+64=125).

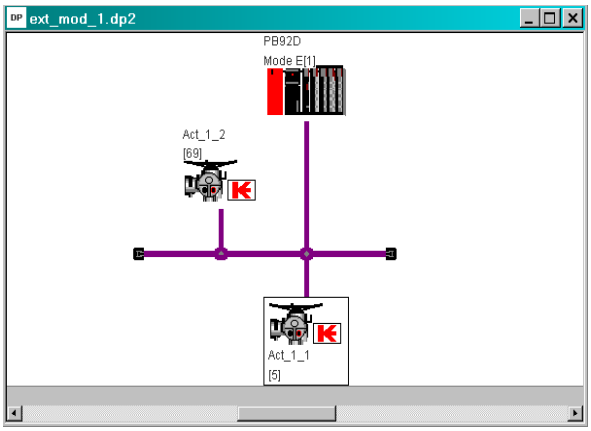

Figure 9. Configuration showing two slave nodes for a single Actuator. Primary address of 5.

When the card is powered 'on', Channel 1 will be the Primary channel. If the card does not enter Configuration Mode within 2 seconds (because there is no master present) then Channel 2 will take over as Primary, once again if there is no communication within 4 seconds, then it will revert to Channel 1 and now it will wait 8 seconds before Channel 2 assumes Primary status. The switch over time will increase by a factor of 2 each time until it reaches its maximum of 32 seconds.

It will continue to switch channels using a 32 second switch over time until one channel receives PLC messages.

In the event of a failure of the Primary channel, the **Backup automatically changes to use the Primary address**. Hence for all control purposes the Master only uses the Primary address. The Backup address can be used for exchanging data but any commands to move the actuator directed to the backup address will be ignored. If a configuration message is sent to the Backup address that is different to the one sent to the Primary address it will be accepted, but not actioned. The data exchanged between the master and the Primary includes information on the status of the device and hence the availability of a Backup should the Primary fail.

RedCom.
The Rotork Profibus DP (Mk2) RedCom Dual Channel Option Card (RTRR0845.gsd) obeys the Profibus REDCOM Specification for Redundant Communications. This includes 3 bytes of Extended Diagnostics for RedState.

The QJ71PB92D master module will accept the GSD file and will control the network correctly. However when the Actuator issues a RedCom message the QJ71PB92D displays the error LED.
This error is not fatal and the network will continue to run.

The RedCom mode can be disabled by changing parameter 15 in the GSD file to the appropriate value. Allowable values can be found if the GSD is read with a suitable text editor such as 'notepad'.

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