CMU - Robotics Institute **Manipulation Lab**

ABB Robot I/O (IRC5 controller)

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This is a brief tutorial on how I/O works on IRC5 ABB controller and how to set up input and output signals.

1 Physical level

The ABB controller supports communication boards: Ethernet, DeviceNet, PROFIBUS and INTERBUS. They are located in the vertical racks in a PC inside the controller, Fig. 1. The controller in the Manipulation

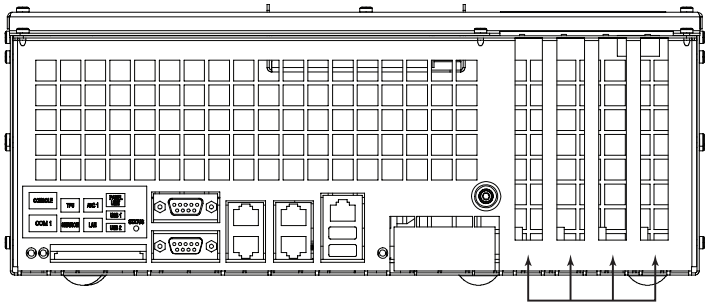

Figure 1: PC internal to the ABB controller.

Lab has a DeviceNet board installed in the leftmost vertical rack.

DeviceNet communication consists of a Master/Slave structure. The board in the vertical rack (DSQC 658) is the master and distributed or slave I/O units connect to it, including units with digital I/O (DSQC 652), analog I/O (DSQC 355A), digital I/O with relays (DSQC 653) or various combinations. The controller in the Manipulation Lab has a DSQC 652 slave I/O unit, Fig. 2, located in the back of the front door. It allows for 16 digital outputs and 16 digital inputs, all working with 24 V logic. The top connectors are optically isolated digital outputs and the bottom ones are optically isolated digital inputs. The unit is correctly setup and working if the two LEDS (NS and MS) in the bottom right corner are green.

To physically connect a digital output you have to:

- Supply 24V power source to pin 10 of X1 connector.
- Connect ground power source to pin 9 of X1 connector.
- Draw output signal from the correspondent pin in X1 or X2 connector. Output channels 1 to 8 are mapped to pins 1 to 8 in X1. Output channels 9 to 16 are mapped to pins 1 to 8 in connector X2.

A more detailed description of the connectors and LEDs in the DSQC 652 I/O unit can be found on pages 77-81 of the Application Manual: DeviceNet.

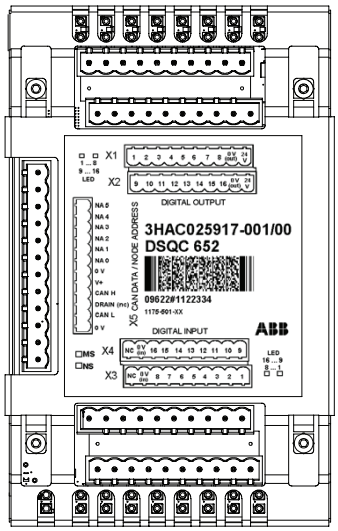

Figure 2: DSQC 652 I/O unit in the back of the front door of the IRC5 controller.

2 Software level

Three things need to be configured at software level to use the I/Os of the controller:

- Communication Bus (Device Net).
- I/O Unit connected to the bus (DSQC 652).
- Input and output signals mapped to the I/O unit.

2.1 Bus

A bus is an abstraction of a communication device. It is configured inside I/O system parameters — through the teach pendant: Control Panel → Configuration → I/O Topic → Bus. Inside Bus, there should be a DeviceNet bus configured. In the case of the Manipulation Lab controller, it is named DeviceNet1.

Configuration parameters:

Type DeviceNet.

Master Address 2 in the case of the Mlab controller.

Communication Speed 500kbs in the case of the Mlab controller.

For a detailed description of the rest of parameters, look into pages 138-146 of the Technical Reference Manual: System Parameters.

2.2 Unit

A unit is an abstraction of a slave device connected to a bus. It is configured inside I/O system parameters — through the teach pendant: Control Panel → Configuration → I/O Topic → Unit. Inside Unit there

should be a device that represents the unit connected to the DeviceNet bus. In the case of the Manipulation Lab controller, it has the name IOboard and represents the DSQC 652 unit in the back of the front door.

Configuration parameters:

Name User defined name of the slave I/O unit (IOboard).

Type of Unit Identifies the type of slave I/O unit connected to the Bus (d652).

Connected to Bus Bus where the slave I/O unit is connected (DeviceNet1).

Unit Identification Label User defined description of the unit.

DeviceNetAddress Number 0-63 that identifies the address of the slave I/O unit in the bus.

The address is coded in binary in the pins 7-12 of the X5 connector in the same slave unit. Fig. 3 shows the binary codification of the address with the pins. The configuration in the figure is the one present in the Manipulation Lab controller, yielding address 10.

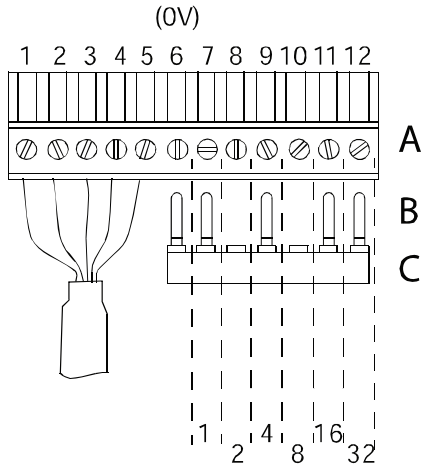

Figure 3: Configuration of the DeviceNet bus ID. Example: cut address pins 8 and 10 to obtain address 10.

2.3 I/O Signals

To create a new I/O signal, go to Control Panel → Configuration → IO/Topic → Signal → Add.

Configuration Parameters:

Name Name to use to access the signal through RAPID.

Type of signal To choose from: Digital Input, Digital Output, Analog Input, Analog Output, Group Input and Group Output. In the case of the Mlab controller, only digital signals are available.

Assigned to Unit Unit where the signal will be assigned to (IOboard).

Signal Identification Label User defined description of the signal.

Unit Mapping Number identifying the input/output pin in the I/O unit. The numbers 0-15 map to the channels 1-16, as shown in Fig. 4.

Input map

The figure below shows the digital input mapping.

Input byte	Bit								Bit range
	7	6	5	4	3	2	1	0	
0	DI 8	DI 7	DI 6	DI 5	DI 4	DI 3	DI 2	DI 1	0-7
1	DI 16	DI 15	DI 14	DI 13	DI 12	DI 11	DI 10	DI 9	8-15

Output map

The figure below shows the digital output mapping.

Output byte	Bit								Bit range
	7	6	5	4	3	2	1	0	
0	DO 8	DO 7	DO 6	DO 5	DO 4	DO 3	DO 2	DO 1	0-7
1	DO 16	DO 15	DO 14	DO 13	DO 12	DO 11	DO 10	DO 9	8-15

Figure 4: Digital input and output mapping.