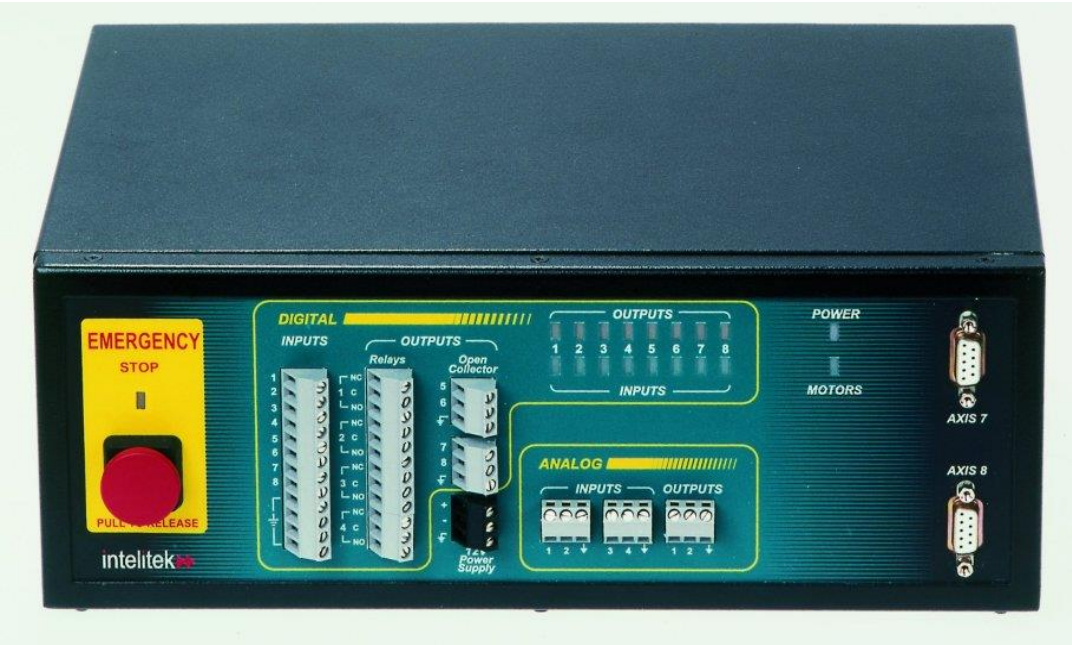
Controller-USB



User Manual

Catalog # 100341, Rev. H

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Controller-USB User Manual

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Table of Contents

1

General Information

About Controller-USB

Controller-USB is part of the SCORBOT robotic system. In addition to the robot arm, it can also be used to control peripheral motorized devices. A teach pendant is available for this system.

The basic robotic system is comprised of three hardware components:

- Controller-USB
- SCORBOT robot arm
- Computer

The robot, teach pendant and controller are shown in Figure 1-1.

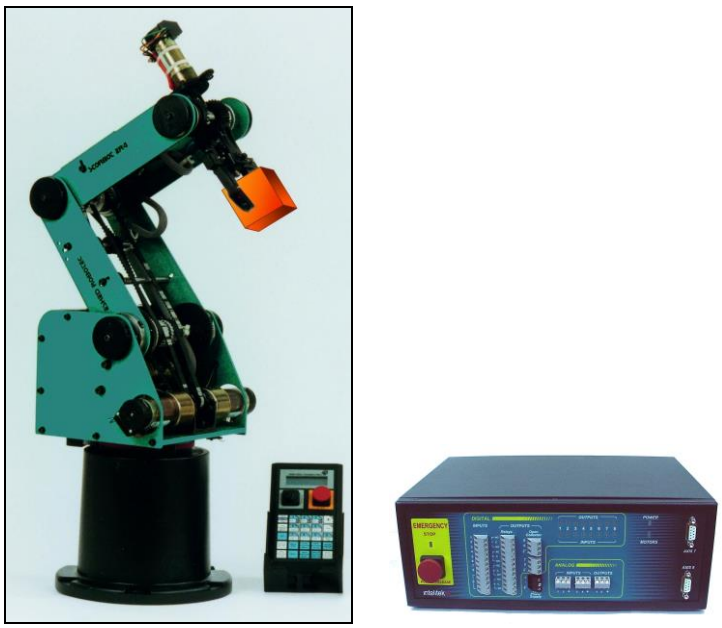


Figure 1-1: System Overview

The computer is connected to Controller-USB via a USB cable. The robot is connected to Controller-USB by a proprietary interface cable. See block diagram in Figure 1-2.

Controller-USB controls the 24V power supply to six robot motors and to two optional peripheral device (axes 7 and 8).

Controller-USB contains the circuits that read the encoder and microswitch signals, and control the motors by means of PWM signals.

Analog and digital I/O devices can also be interfaced with Controller-USB via the digital and analog I/O ports.

Controller-USB can be connected to:

- Teach pendant, which enables direct manual control of axes
- Two motorized peripheral devices
- Analog and digital I/O devices
- RS-232 communication port (reserved for future use).

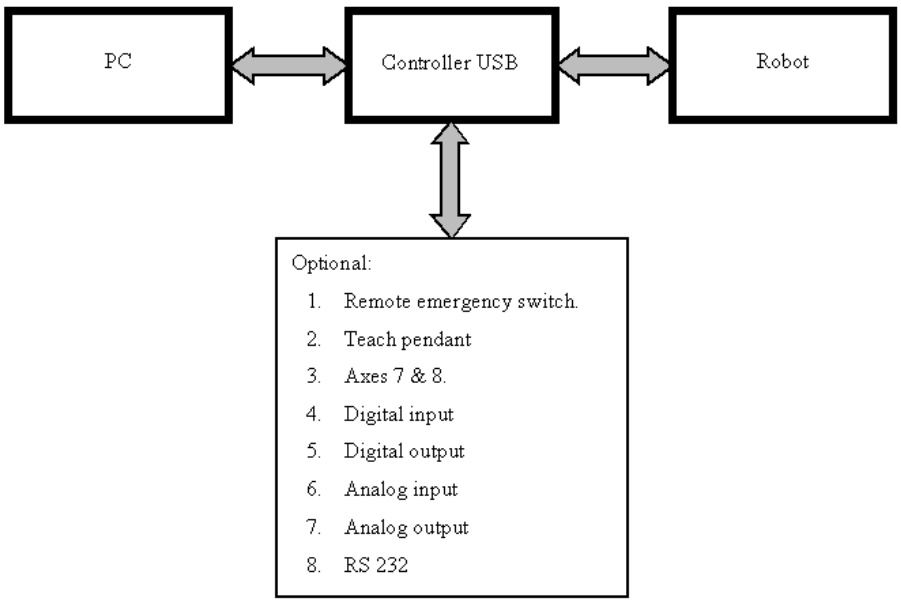


Figure 1-2: Block Diagram

Inspection and Acceptance

After removing Controller-USB from the shipping carton, examine all components for signs of shipping damage. If any damage is evident, do not install or operate Controller-USB. Notify your freight carrier and begin appropriate claims procedures.

The following items are standard components in Controller-USB package.

Make sure you have received all the items listed on the packing list. ***Be sure to check the packing list for the robot and peripherals as well***. If anything is missing, contact your supplier.

Controller-USB Packing List	
1.	Controller-USB 110/220 VAC
2.	Cables: Power Cable 110/220 VAC USB Cable Remote emergency switch bypass cable.
3.	Emergency Bypass Plug (required when the Teach Pendant is not connected)
4.	on CD-ROM: SCORBASE software RoboCell software
5.	Documentation: Controller-USB User Manual SCORBASE User Manual RoboCell User Manual
6.	Teach Pendant (TP) (Optional and supplied only when ordered): Teach Pendant Mounting fixture User Manual

Figure 1-3: Packing List

Repackaging Controller-USB

Save the packing materials and shipping carton. You may need them later for shipment or storage of Controller-USB.

Controller-USB should be repacked in its original packaging for transport.

Specifications

The following table describes Controller-USB specifications:

Item	Specification
Type of Control	Real time; Multi-tasking; PID (proportional, integral, differential); PWM (pulse width modulation).
Number of Servo Axes	Maximum: 8
Groups of Control	6 robot axes and 2 peripheral axes. Axis interpolation in robot and peripherals groups.
Axis Drivers	PWM H-bridge drivers 15 kHz, 3A standard; 7A peak 12/24V (depending on input voltage and load)
Path / Trajectory Control	CP: Joint; Linear; Circular. 1.5 ms control cycle parameter. Software controlled acceleration/deceleration. PID parameters.
Speed Control	Speed or Travel time definitions. Ten speed levels are available
Control Parameters	I/O control Speed, velocity profile, smoothing Axis position error Gripper operation Impact, software limit protection Homing Encoder interface Cartesian calculations
Power Requirements	110/220V AC (+15%, -10%), 50/60Hz, 180W max.
Internal Power Supplies	Servo: 24V (depending on input voltage and load) Digital: 5V, +15V, -12V
Weight	7 kg (15.4 lb)
Dimensions	L=31.5cm; W=22.3cm; H=11.7cm (L=12.4"; W=8.8"; H=4.6")
Ambient Operating Temperature	10°–35° C (50°-95° F)
Microcontroller	NEC V853
Communications	USB interface with PC; Integrated RS-232 channel for teach pendant
User power supply	12V DC 0.1A max.

Item	Specification
Digital Outputs	8 digital outputs: 1 – 4: relays 24 V (AC or DC), 1.0 A max. 5 – 8: sink/source configurable open collectors Sink: 15 VDC, 0.5 A max. for each output Source: 15 VDC, 50 mA max. for all outputs combined
Digital Inputs	8 Dry Contacts: PNP/NPN (high/low) configurable 0-24 VDC max.
Analog Outputs	2 analog outputs: 8-bit resolution; output voltage 0–10 VDC, 20 mA max.
Analog Inputs	4 analog inputs: (8-bit resolution) Input voltage 0–10 VDC
Programming and Position Teaching	SCORBASE software; PC user-defined programming with C++; RoboCell 3D simulation software (optional); Teach Pendant (optional)
Types of Positions	Absolute; Relative; Cartesian; Joint (angle); Encoder
Position Feedback	Incremental optical encoders for each axis
Coordinate Systems	XYZ coordinates; Joint coordinates
LED Indicators	Main power, bicolor: green: power on and communicating with PC orange: power on and not communicating with PC flashing: power on and PC USB communications timeout 8 digital inputs (green) 8 digital outputs (orange) Motors (green) Emergency (red)
Safety Features	Emergency cutoff switches: on Controller-USB; on Teach Pendant; optional external connection for remote switches.
	Short-circuit protection; On overheating, driver power shutdown; On failure, motor power shutdown; On communication failure, motor power shutdown.
	Impact, software limit protection Hardware watchdog for each axis protects against software faults.

Figure 1-4: Controller-USB Specifications

2

Safety

Handling Controller-USB

Do not hold Controller-USB by either the front or rear panels.

Make sure that all cables are disconnected before moving Controller-USB.

Warnings

- Do not operate Controller-USB until you have studied this manual thoroughly.
- Do not install or operate Controller-USB under any of the following conditions:
  - Power supply is not grounded
  - Ambient temperature drops below or exceeds the specified limits
  - Exposed to large amounts of dust, dirt, salt, iron powder, or similar substances
  - Subject to vibration or shocks
  - Exposed to direct sunlight
  - Subject to chemical, oil or water splashes
  - Corrosive or flammable gas is present
  - Power line contains spikes
  - Near any equipment that generates large electrical noise.
- Turn off Controller-USB before you connect any inputs or outputs.
- Turn off Controller-USB before you connect any peripheral devices.
- Be sure to configure the peripheral axes using SCORBASE before you send a Control-ON command to the peripheral device.
- Do not plug Controller-USB into the AC power outlet before making sure that its voltage requirement (as marked at the rear panel of Controller-USB) matches your voltage supply.

  If the voltage setting does not match your supply, follow the instructions for changing the controller's voltage setting in Chapter 6, "Maintenance and Repair".

- Do not connect voltage source exceeding +24V to input terminals.
- Do not connect any input or output device that does not meet Controller-USB specifications.
- Never connect voltage from an external power supply directly to any open collector outputs.
- Always connect the open collector outputs to a load that meets Controller-USB specifications.
- Do not exceed current limitations for open collector outputs:
  Sink: 0.5A for each output
  Source: 50 mA for all outputs combined
- Make sure that the voltage supply of a device connected to a relay output does not exceed 24 V.

Emergency Button

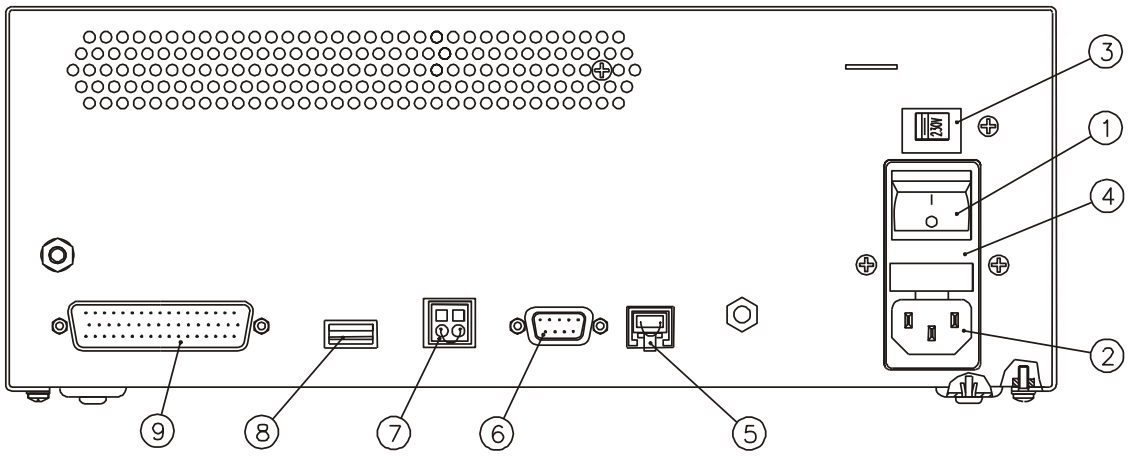
Pressing the Emergency button disconnects the power signals to the robot and Axes 7 and 8, and halts the SCORBASE program. The digital and analog outputs freeze their status. The red LED indicator comes ON.

3

Installation

Getting to Know Controller-USB

Before beginning installation, it is recommended that you familiarize yourself with Controller-USB. Refer to Figures 3-1 and 3-2 and the legends that follow.



Legend: Controller-USB Rear Panel	
1	Power On/Off Switch
2	Power Line 110/220 VAC socket
3	Line Voltage Selector
4	AC Power Fuse Drawer - 110V 2A; 220V 1A
5	TEACH PENDANT connection
6	Reserved for future use
7	Remote EMERGENCY switch 2-pin connector
8	USB connector (to PC)
9	Robot 50-pin D-type connector

Figure 3-1: Controller-USB - Rear Panel

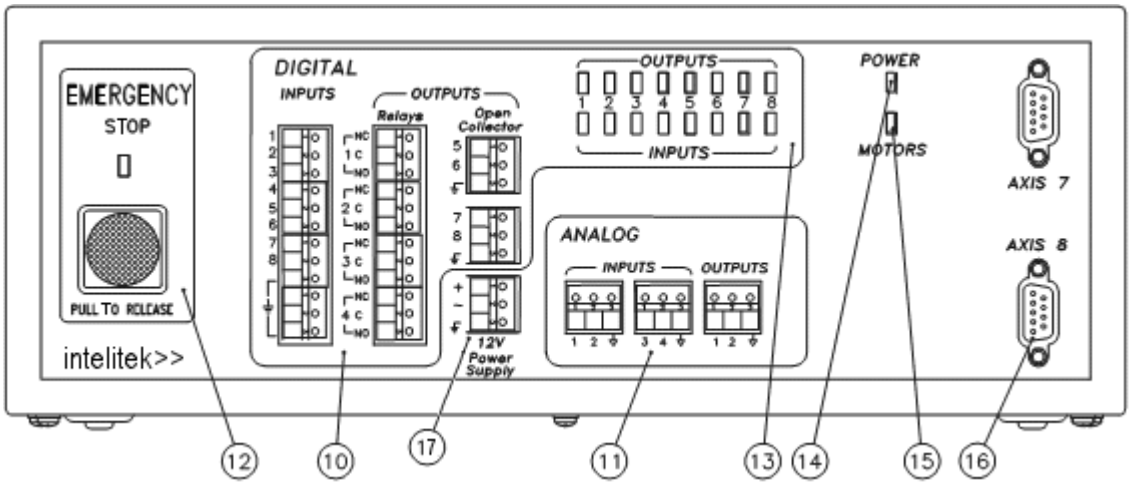


Figure 3-2: Controller-USB - Front Panel

Legend: Controller Front Panel	
10	Digital Input / Output terminals
11	Analog Input / Output terminals
12	Emergency Button and LED indicator
13	Digital Input / Output LED indicators
14	Power LED indicator. See below.
15	Motors LED indicator (lit when control on). See below.
16	Axes 7 and 8 driver D9 connectors (separate for each device)
17	Auxiliary 12 VDC power supply - 0.1 Amp max.

When software is activated in online mode, the POWER LED changes color to indicate the following:

- **Green:** The controller is turned on and is currently communicating with the PC.
- **Orange:** The controller is turned on but is currently **not** communicating with the PC.
- **Flashing:** The controller is turned on and is there is currently a PC-USB timeout. This is the normal state for Robocell in simulation mode. It may also indicate a USB communications problem when Robocell is working in online mode.

The green MOTORS LED indicates whether or not power is being supplied to all connected motors. This LED lights after SCORBASE is activated and the CON (control on) command is issued.

The MOTORS LED goes out whenever any of the following occurs:

- COFF (control off) command is issued.
- EMERGENCY button is pressed.

- Controller-USB detects a communication time-out.
- Controller-USB detects an over-current error.
- SCORBASE closes.

Computer Requirements

To operate and control the robot using SCORBASE and Controller-USB, the following requirements must be met:

- Pentium IIIPC with 350 MHz processor, or higher.
- Minimum 128 MB of RAM.
- Hard drive with at least 20 MB of free disk space.
- Windows 98/2000/XP.
- Super VGA or better graphics display, minimum 256 colors.
- A mouse or other pointing device.
- USB port.

Installing Controller-USB

Do not connect Controller-USB to the AC power supply yet. Complete Steps 1-5 first.

The numbers in parentheses refer to Figures 3-1 and 3-2.

1. Make sure that Controller-USB voltage setting (3) matches your power supply. If the voltage setting does not match your supply, refer to Changing the Voltage Setting in the chapter entitled “Maintenance”.
2. Make sure the controller’s power switch (1) is turned off.
3. Connect the controller’s USB socket (8) to a USB socket on the computer.
4. Connect the robot cable to the ROBOT port (9) on the controller. Tighten the connector screws.
5. If a teach pendant will *not* be used, connect the emergency bypass plug to the teach pendant port (5) on the controller’s rear panel.

   To use a teach pendant, connect it to the TEACH PENDANT port (5) on the controller’s rear panel.

   It is recommended that you set the Teach Pendant Auto/Teach switch to AUTO before you power on the system. If the switch is set to AUTO, the robot can be controlled either from the teach pendant or via Controller-USB. For more details, refer to the teach pendant’s user manual.
6. Connect the power cable to the POWER socket (2) on the controller’s rear panel and to a grounded AC power source.

7. If a remote emergency switch is not in use, connect the emergency switch bypass cable to the EMERGENCY terminal (7) on the controller's rear panel.
8. To install a remote emergency switch, refer to the section, "Remote Emergency Switch Installation" below.
9. Ensure that the SCORBASE or RoboCell software is running.
10. Once you have made all the required hardware connections, you can turn Controller-USB on with the Power On/Off switch (1).
11. After you turn on the controller, the power indicator LED (14) lights up. Its color indicates whether the controller is communicating with the PC (green) or not communicating (orange).

Installing Peripheral Axes

The D9 connectors on the front panel of Controller-USB, marked AXIS 7 and AXIS 8, are used for connecting optional SCORBOT motorized devices that can be controlled by Controller-USB.

The following SCORBOT peripheral devices are supported by Controller-USB:

- Conveyor belt (gray), 24V
- Linear positioning table 0.3 m, 24V
- XY positioning table, 24V
- Rotary table, 24V
- Motor kit (127:1), 24 V
- Slidebase (USB), 1.0 m, 24V
- Slidebase (USB), 1.8 m, 24V

To connect peripheral axes, do the following:

1. Turn off Controller-USB before you connect any devices.
2. Configure the peripheral axes using the SCORBASE software. Refer to the SCORBASE user manual.

   If you are connecting only one peripheral, use the AXIS 7 connector.
3. Tighten the cable connector screws.
4. Connect the peripheral device's D-type connectors to the D9 connectors on the controller's front panel.

Installing a Remote Emergency Switch

The EMERGENCY terminal at the back of Controller-USB (7) allows you to add a remote switch (such as a mushroom button) that will function exactly like the controller's EMERGENCY stop button.

To connect a remote emergency switch, do the following:

1. Make sure the EMERGENCY terminal contacts are normally closed (NC).
2. Remove the jumper wire that shorts the two terminals of the EMERGENCY terminal (7) on the rear panel of Controller-USB. To do so, insert a small screwdriver into the upper (square) opening of the terminal and press down to release each end of the wire.
3. Connect the two wires from the remote emergency switch terminals to the EMERGENCY terminal (7). To do so, insert a small screwdriver into the upper (square) opening of the terminal and press down while inserting each wire into the lower (round) openings of the terminal. Remove the screwdriver to clamp the wire in place.

4

Inputs and Outputs

Input Terminals and LEDs

Controller-USB has 8 digital inputs and eight green LEDs which light up when any of the eight corresponding digital inputs is on. There are also 4 analog inputs.

Controller-USB digital inputs are factory pre-set to LOW. These settings may be changed by the user according to the instructions in Chapter 6. For proper I/O operation, the proper setting must be selected for the type of sensor being connected, as shown in the following table:

Digital Sensor Type	Jumper Setting
Dry-contact (unpowered)	LOW
Dry-contact (powered)	HIGH
Semiconductor (sink)	LOW
Semiconductor (source)	HIGH

To change the input setting, refer to Chapter 6, particularly Figure 6-2: I/O Jumpers.

The input states are read by SCORBASE software commands. Generally speaking, when the jumper is set to LOW, a low voltage is interpreted by the controller as ON, and when the jumper is set to HIGH, a high voltage is interpreted as ON. See below for more specifics.

Note: Do not connect DC current from a power supply except as shown in these instructions. ***Connecting DC power with reversed polarity may damage the electronic circuits and components in Controller-USB, as well as any connected electronic sensors. Do not connect AC power to any input on Controller-USB.***

Digital Inputs

Two types of devices can be connected to digital inputs 1–8:

- A dry-contact switch or sensor.
- Semiconductor switching devices.

When not connected, the digital input is interpreted as OFF, regardless of the jumper setting.

When set to LOW, the factory default setting, the digital input is interpreted as ON when it receives a 0 to 2.0V signal.

When set to HIGH, the digital input is interpreted as ON when it receives a 2.5V to 24V signal.

Input signals between 2.0 V and 2.5 V produce unpredictable results.

	Unconnected	0-2.0 V	2.5-24 V
LOW	OFF	ON	OFF
HIGH	OFF	OFF	ON

Dry-Contact Switches

A dry-contact switch can be used as a sensor either by itself or connected to an external source of DC power.

Switch Alone (LOW)

Be sure the digital input terminal is set to LOW. See Chapter 6, particularly Figure 6-2: I/O Jumpers. Connect the device to a digital input terminal and to a digital input ground on Controller-USB. Closing the switch turns the input ON.

The interconnection scheme is shown in Figure 4-1.

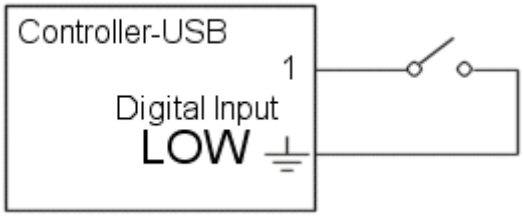


Figure 4-1: Interconnection Scheme: Dry-contact switch alone

Notes:

- Any type of ordinary electrical contact switch is suitable, including a mercury switch, relay or reed switch.
- Before connecting any sensor to any input, be sure Controller-USB is switched OFF.

Switch With External Power Source (HIGH)

Be sure the digital input terminal is set to HIGH. See Chapter 6, particularly Figure 6-2: I/O Jumpers. Connect the device to a Controller-USB digital input terminal and to the positive voltage terminal of the power supply. Connect the power supply ground to a digital input ground on Controller-USB. Closing the switch turns the input ON, as long as the power supply provides more than 2.5 VDC.

The maximum voltage is 24 V. The interconnection scheme is shown in Figure 4-2.

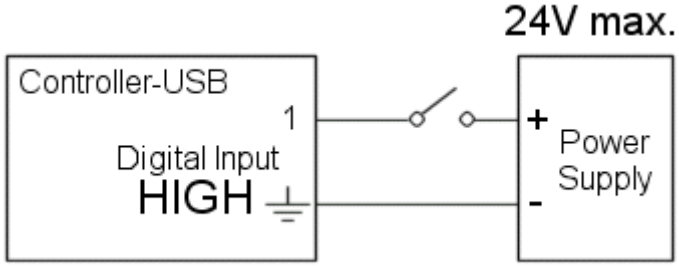


Figure 4-2: Interconnection Scheme:
Dry-contact switch with external power source

Notes:

- Any type of ordinary electrical contact switch is suitable, including a mercury switch, relay or reed switch.
- ***Connecting DC power with reversed polarity may damage the electronic circuits and components in Controller-USB. Do not connect AC power to any input on Controller-USB.***
- Before connecting any sensor to any input, be sure Controller-USB is switched OFF.

Semiconductor Switching Devices

Semiconductor switching devices of either NPN (sink) or PNP (source) type can be used with the digital inputs on Controller-USB.

Sink Devices (NPN) (LOW)

Be sure the digital input terminal is set to LOW (the factory preset). See Chapter 6, particularly Figure 6-2: I/O Jumpers.

Connect the sensor output (the open collector terminal) to a Controller-USB input, and the sensor ground to the input ground on the controller, as shown in Figure 4-3. The power supply (24 VDC maximum) is also connected as shown. Note that the sensor input terminal is not shown, as each electronic sensor has its own design.

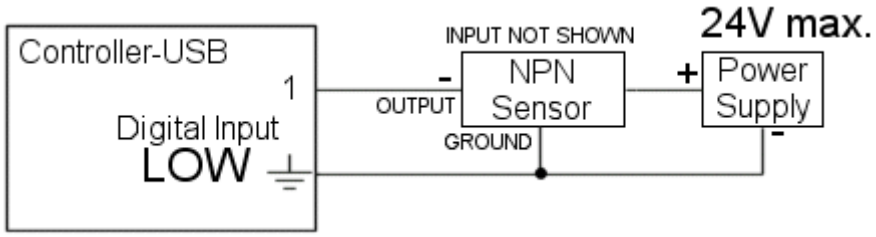


Figure 4-3: Interconnection Scheme: Electronic sensor (NPN/sink-type) with external power source

Notes:

- Before connecting any sensor to any input, be sure Controller-USB is switched OFF.
- Do not connect voltage exceeding 24 VDC to the digital inputs.
- ***Connecting DC power with reversed polarity may damage the electronic circuits and components in Controller-USB and external sensors. Do not connect AC power to any input on Controller-USB.***
- The Controller-USB inputs are factory pre-set to LOW, which is suitable for NPN sensors (open-collector or sink type).
- For NPN sensors, the voltage and input states are as follows:

	Unconnected	0-2.0 V	2.5-24 V
LOW	OFF	ON	OFF

- This is the same interconnection scheme as for PNP devices, but the jumper settings on Controller-USB are different.
- You can use the 12 VDC power supply on Controller-USB to power an external electronic sensor. [(17) on Figure 3-2] ***Be sure to observe the polarity.***
- To simulate the operation of an NPN device, you can connect a Controller-USB digital output to a Controller-USB digital input. Set the output jumper to SINK and the input jumper to LOW.

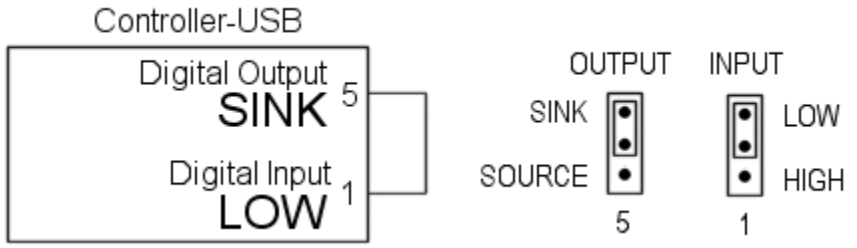


Figure 4-4: Interconnection Scheme: Simulating NPN device

Source Devices (PNP) (HIGH)

Be sure the digital input terminal is set to HIGH. See Chapter 6, particularly Figure 6-2: I/O Jumpers.

Connect the sensor output (the open emitter terminal) to a Controller-USB digital input, and the sensor ground to the input ground on Controller-USB, as shown in Figure 4-5. The power supply (24V maximum) is also connected as shown. Note that the sensor input terminal is not shown, as each electronic sensor has its own design.

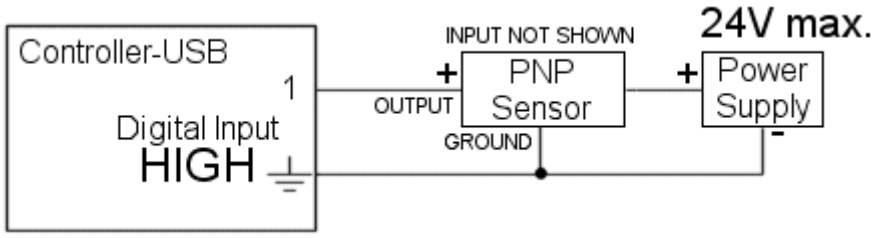


Figure 4-5: Interconnection Scheme: Electronic sensor (PNP/source-type) with external power source

Notes:

- Before connecting any sensor to any input, be sure Controller-USB is switched OFF.
- Do not connect voltage exceeding +24 VDC to the digital inputs.
- ***Connecting DC power with reversed polarity may damage the electronic circuits and components in Controller-USB and external sensors. Do not connect AC power to any input on Controller-USB.***
- The Controller-USB inputs are factory pre-set to LOW, which is suitable for NPN sensors (Open-collector or sink type). To use PNP sensors (open emitter type), change the input jumper to HIGH, as described in Chapter 6, particularly Figure 6-2: I/O Jumpers.

- For PNP sensors, the voltage and input states are as follows:

	Unconnected	0-2.0 V	2.5-24 V
HIGH	OFF	OFF	ON

- This is the same interconnection scheme as for NPN devices, but the jumper settings on Controller-USB are different.
- You can use the 12 VDC power supply on the controller to power an external electronic sensor. [(17) on Figure 3-2] ***Be sure to observe the polarity.***
- To simulate the operation of a PNP device, you can connect a Controller-USB digital output to a Controller-USB digital input. Set the output jumper to SOURCE and the input jumper to HIGH.

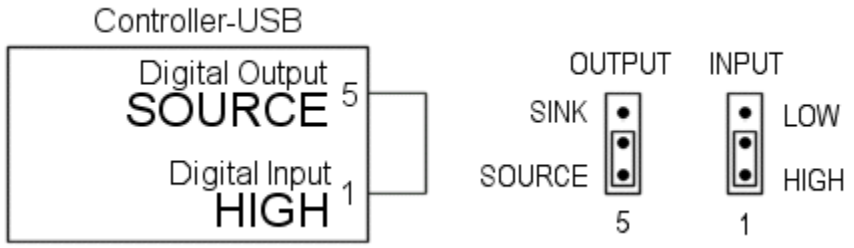


Figure 4-6: Interconnection Scheme: Simulating PNP device

Analog Inputs

Analog Inputs 1-4 allow Controller-USB to receive data from analog sensors.

DC voltage between 0 and 10 volts may be provided to the analog inputs. The analog inputs are read with an 8-bit resolution by SCORBASE software commands.

Figure 4-7 shows the interconnection scheme for a passive sensor such as a thermistor or photoresistor.

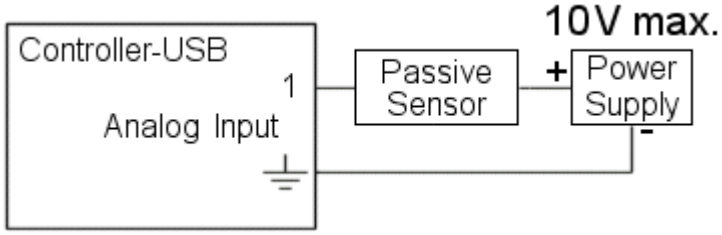


Figure 4-7: Interconnection Scheme: Passive Analog Input

Figure 4-8 shows the interconnection scheme for an electronic analog sensor. Note that the sensor input terminal is not shown, as each electronic sensor has its own design.

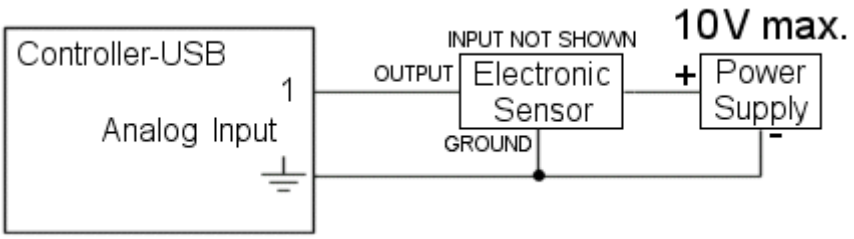


Figure 4-8: Interconnection Scheme: Electronic Analog Input

Notes:

- Before connecting any sensor to any input, make sure Controller-USB is switched off.
- Do not connect voltage exceeding +10 VDC to the analog inputs. Note that this is significantly lower than the limit for digital inputs.
- ***Connecting DC power with reversed polarity may damage the electronic circuits and components in Controller-USB and external sensors. Do not connect AC power to any input on Controller-USB.***
- The voltage from 0 to 10 VDC is interpreted as an 8-bit binary number between 0 and 255.
- To power the external analog sensor, you can use the 12 VDC power supply on the controller. [(17) on Figure 3-2] ***Be sure to observe the polarity, and be sure to protect against accidentally providing more than 10V to the analog sensor input.***

Output Terminals and LEDs

The output terminals allow Controller-USB to control external devices in the robot's environment. Controller-USB has 10 outputs, as follows:

- 4 digital relay outputs
- 4 digital open collector outputs
- 2 analog outputs

There are eight orange LEDs which light up when any of the eight corresponding digital outputs is on.

Relay Outputs

Digital outputs 1 to 4 are relay outputs. The relay outputs are controlled by SCORBASE software commands.

Maximum voltage allowed: 24 V (AC or DC)
Maximum current allowed: 1.0 A

Each relay output has three contact points:

- Common (C)
- Normally Closed (NC)
- Normally Open (NO).

Normally (when the relay is not energized by a SCORBASE command), the NC terminal is electrically connected to the COM terminal, and the NO terminal is disconnected. When the relay is activated, the connections are reversed: the NO terminal closes and the NC terminal opens.

Figure 4-9 shows the interconnection scheme for devices via relay outputs.

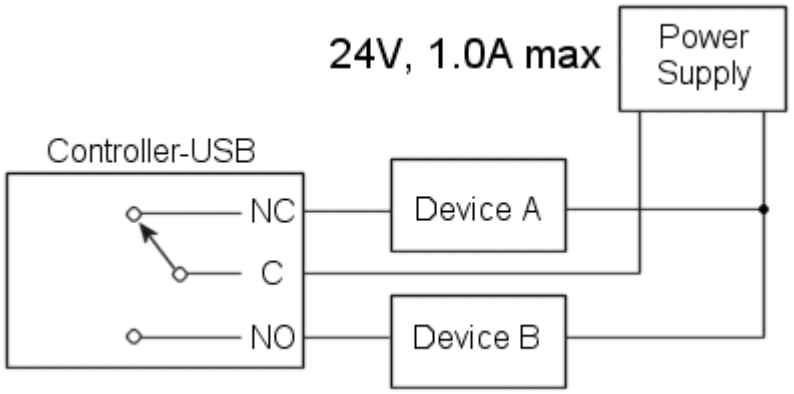


Figure 4-9: Output Relay (1 - 4) Interconnection Scheme

In this configuration, the devices are activated by SCORBASE according to the following truth table:

SCORBASE Output state	Device A (NC)	Device B (NO)
OFF	**ON**	**OFF**
ON	**OFF**	**ON**

Open Collector Outputs

Digital outputs 5 to 8 are open collector outputs. When set to SINK (the factory pre-set), the final component of each circuit is an NPN transistor with an open collector connected to the output terminal. These outputs must be connected to a load such as a resistor, solenoid, relay or motor. When using an inductive load such as a solenoid or a relay, connect a reverse-biased protection diode across the load. See Device B as illustrated in Figure 4-10. ***Omitting this precaution may damage electronic circuits or components in Controller-USB.***

You may directly connect a Controller-USB open collector output to a Controller-USB digital input.

Never connect voltage from a power supply directly to an open collector output (terminals 5-8). The open collector outputs must always be connected to a load of the following rating:

> Power supply voltage: 15 VDC max.
> Maximum current: 0.5 A each; 2.0 A for all open collector outputs combined

The interconnection scheme (SINK) is illustrated in Figure 4-10.

Device A will be energized when SCORBASE turns Output 5 ON. Device B will be energized when Output 6 is turned ON.

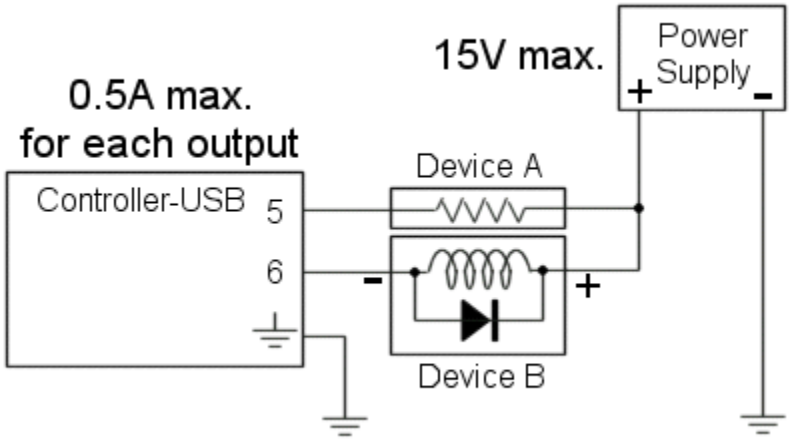


Figure 4-10: Interconnection Scheme: Sink Output

Notes:

- The open-collector outputs are factory pre-set to SINK. To change the setting to SOURCE, refer to Chapter 6, particularly Figure 6-2: I/O Jumpers.
- Open-collector outputs may be connected to digital inputs on controller-USB.

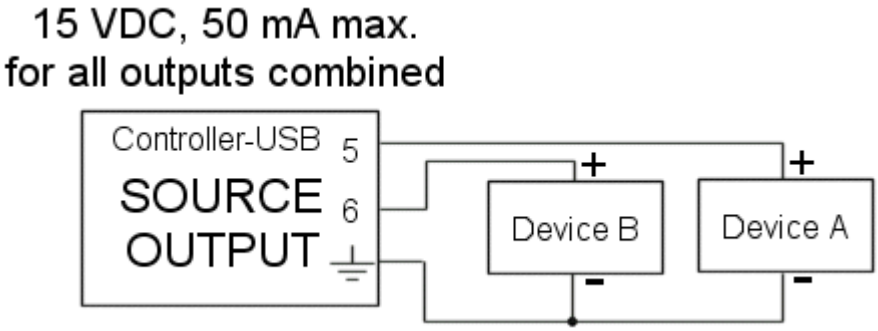


Figure 4-11: Interconnection Scheme: Source Output

Notes:

- The open-collector outputs are factory preset to SINK. To change the setting to SOURCE, refer to Chapter 6, particularly Figure 6-2: I/O Jumpers.
- Do not connect a digital output (SOURCE) to an analog input, as the 15 V provided by the digital output exceeds the maximum 10 V permitted for an analog input.
- A digital output (SOURCE) may be connected to a digital input, as long as the digital input is set to HIGH. To change the input setting to HIGH, refer to Chapter 6, particularly Figure 6-2: I/O Jumpers.

Analog Outputs

Analog outputs 1 and 2 allow you to control devices that operate using an analog input voltage, such as an LED or a motor driver.

The analog outputs have an 8-bit resolution D/A converter (DAC) and an output voltage of 0–10V DC. The voltage is controlled via SCORBASE (output word 0–255 ⇔ 0–10 V).

The analog output current is limited to 20 mA. Use a hardware driver (booster) to energize a device requiring higher voltage or current.

Figure 4-12 shows the interconnection scheme for analog outputs.

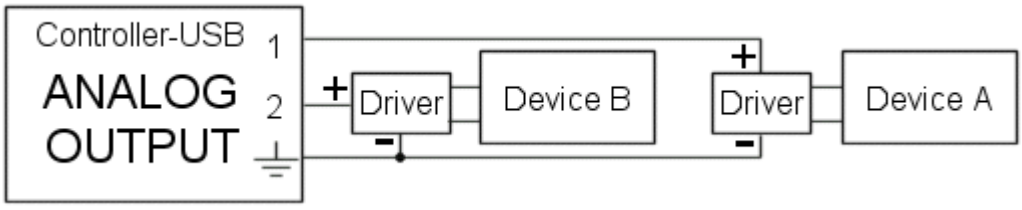


Figure 4-12: Interconnection Scheme: Analog Outputs

5

Emergency Switches

EMERGENCY Button and LED

When the red EMERGENCY button on the front panel or a remote EMERGENCY stop switch is pressed, the following occurs:

- Motor power is disconnected; all motor movement stops and the Motors LED turns off.
- COFF (control off) state is activated.
- Emergency LED lights up.
- An emergency message is displayed on the teach pendant and in SCORBASE.
- Program is aborted.
- Controller-USB outputs freeze in their current state.
- All SCORBASE commands, including HOME and CON cannot be activated.

Note:
Pressing the Emergency button will not stop the operation of a remote output device. To stop the output device, use its own Emergency Stop button.

When the EMERGENCY button on the front panel is pulled out or a remote EMERGENCY switch is released, the following occurs:

- The red emergency LED turns off.
- A message appears on the SCORBASE screen, prompting you select CON (control on) to return to the Control On state, or COFF (control off) to remain in the Control Off state.

  If you select CON, the green Motors LED turns on.

Remote Emergency Switch

When a remote emergency switch is connected to Controller-USB (7), it functions exactly like the EMERGENCY button located on the front panel of Controller-USB.

6

Maintenance and Repair

To ensure continued optimum performance of Controller-USB, follow all safety guidelines and warnings and regularly perform the inspection procedure.

Inspection

Perform a routine inspection of your system at the start of every working session, in the following order:

1. Before you power on the system, check the following items:
   - The installation meets all safety standards.
   - The robot is properly secured to the work surface.
   - All cables are properly and securely connected.
     Cable connector screws are fastened.
   - Replace any cables that show signs of abrasion or wear.
   - No output is connected directly to a power supply.
   - No people are within the robot's working area.
2. After you have switched on the PC and Controller-USB, check the following items:
   - The bicolor power LED is orange when the power is ON, and green when power is ON and the software is online.
   - Green Motors LED is on after SCORBASE starts and Control On (CON) is selected.
   - No unusual noises are heard.
   - No unusual vibrations are observed in any of the robot axes.
   - There are no obstacles in the robot's working area.
3. Bring the robot to a position near home, and activate the homing procedure. Check the following items:
   - Robot movement is normal.
   - No unusual noise is heard when robot joins move.

- Robot reaches home position in all five axes, gripper and peripheral axes 7 and 8 (if connected), and Homing Complete message appears.

Troubleshooting

Whenever you encounter a malfunction, try to locate the source of the trouble by replacing the suspected faulty component – for example, the controller, the robot arm, cables – with an identical component from a working system.

Do not open Controller-USB *(except to change jumper setting)*.

There are no user-serviceable parts inside. Do not attempt internal repair procedures. Contact your agent or dealer.

The following guidelines outline common symptoms and possible remedy.

1. *Controller-USB power does not turn on.*
   The power LED on Controller-USB front panel does not light up.
   - Verify that Controller-USB power switch is on.
   - Make sure the AC power matches Controller-USB voltage requirements, as seen on the tag at the back of Controller-USB.
   - If the voltage supply and Controller-USB voltage setting do not match, disconnect immediately, and change the voltage setting, as described later in this chapter. (Switch 3 on Figure 3-1).
   - Make sure AC power is being supplied to the power outlet.
   - Make sure the power cable is connected to both the proper power source and Controller-USB.
   - Check the fuse (4) on Figure 3-1. (2A for 110V and 1A for 220V).

2. *No communication between Controller-USB and computer.*
   Communication error message while operating robot from computer.
   Power LED is orange.
   - Select On-line mode.
   - Make sure the connecting cable is properly connected to Controller-USB and to the computer.
   - If problem persists, replace USB cable.
   - Reinstall the USB driver. Refer to the section entitled “USB Driver Installation” below.

3. *Controller-USB is ON, but robot arm cannot be activated; or one axis fails to respond and an error message is displayed.*
   - Verify that the power LED indicator is green. If it is flashing, check the state of the Emergency Stop switch [(12) on figure 3-2] and verify that the Control state of SCORBASE or RoboCell is on (CON) and not off (COFF).

- Verify that the green Motors LED is lit.
- Make sure an obstacle is not blocking the robot.
- Make sure none of the axes has reached its mechanical limit.
- Make sure the robot cable is properly connected to Controller-USB.
- Reinstall the USB driver. Refer to the section entitled “USB Driver Installation” below.

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4. *The gripper does not respond to open or close commands, or responds incorrectly.*
   - Make sure the robot cable is properly connected to Controller-USB.
   - Turn Controller-USB off, then turn it on again and select on-line mode.
   - If problem persists, contact your agent.

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5. *Motor turns constantly in one direction, or responds incorrectly.*
   - Make sure the robot cable is properly connected to Controller-USB.
   - Turn Controller-USB off. Then turn it on again and select on-line mode.
   - If problem persists, contact your agent.

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6. *Errors in the accuracy of the robot*
   - A faulty encoder may cause position deviations in one or more of the axes during the running of a program.
   - Contact your agent.

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7. *Controller-USB does not receive an input signal.*
   - Check the input wiring.

---

8. *Controller-USB does not issue output signals.*
   - Check the output wiring.
   - Check whether a load has been connected properly.

---

9. *The Home position suddenly changes, and the robot continues operation in relation to the new Home.*
   - This fault may occur continually or occasionally, due to noisy electrical systems.
   - Execute the Home routine, and reload the program you want to run.
   - If the fault occurs frequently, use filtering equipment on your power line.
   - If problem persists, contact your agent.

Opening the Controller

There are no user-serviceable parts inside. Do not attempt internal repair procedures. Contact your agent or dealer.

You may open Controller-USB ***only when you need to change I/O jumper settings:***

1. Disconnect the power supply cable.
2. Release the screws at the bottom of Controller-USB.
3. Slide the cover gently to the rear.

Changing I/O Jumper Settings

To change the digital input setting (high/low) or to change the open collector output setting (sink/source), you must open the controller and access the I/O card.

1. Open the controller, as instructed above.
2. Gently extract the I/O card.
3. Locate the jumpers on the upper right corner of the I/O card as shown in Figure 6-1.
4. Change the jumper settings. Refer to the diagram in Figure 6-2.

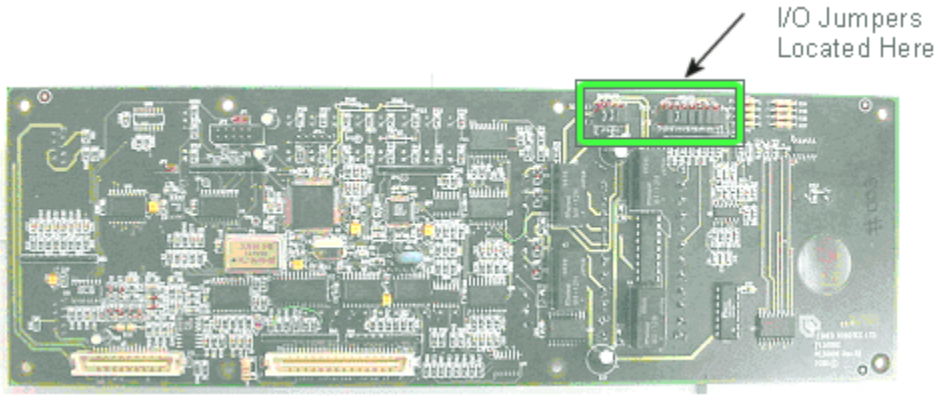

Figure 6-1: Location of Jumpers on I/O Card

Note:
Inputs are factory pre-set to LOW.
Outputs are factory pre-set to SINK.

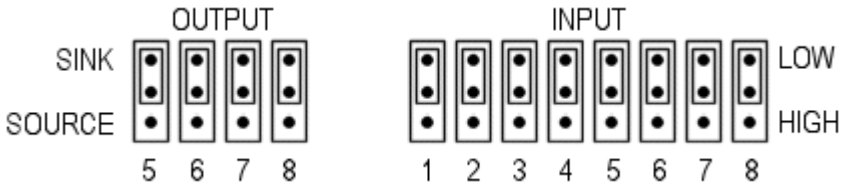

Figure 6-2: I/O Jumpers – Factory Pre-set

Changing the Voltage Setting

If the voltage setting on the Controller-USB does not match your AC power supply, you must change the controller's voltage setting.

Make sure Controller-USB is not connected to an AC outlet while you change the voltage setting.

1. Using a pen or screwdriver, push the voltage selector [switch (3) on Figure 3-1] to the opposite side, so that the proper voltage selection is visible.
2. Again, using a pen or screwdriver, pull out the fuse drawer [(4) on Figure 3-1]. Remove the fuse from its holder.
3. Replace the fuse with the appropriate fuse for your power supply:
   - 110V AC requires a 2A fuse.
   - 220V AC requires a 1A fuse.
4. Reinsert the fuse drawer and push until it snaps into place.

Fuse Replacement

If Controller-USB voltage setting does not match your AC power supply, you must change the controller's AC power fuse.

1. Use a small screwdriver to open the fuse drawer at the rear panel of the controller.
2. Replace the fuse with the appropriate fuse for your power supply:
   - 110V AC requires a 2A fuse.
   - 220V AC requires a 1A fuse.
3. Push the fuse drawer back to its normal position.

USB Driver Installation

During software installation, SCORBASE automatically installs a USB driver named **ERUSBClass** in the computer. If another application has changed the driver, or if the driver has been corrupted, reinstall the **ERUSBClass** driver as follows:

1. Select My Computer.
2. Right click and select Properties (or press Alt+Enter).
   - Click Device Manager
   - Select the ERUSBClass driver and remove it.
3. Reinstall SCORBASE. The correct USB driver will be reinstalled.
4. After SCORBASE installation finishes, reboot Windows.

Appendix A

Schematic Diagram