Shulman

Arix Corporation
Functional Specification
80-02580-02-2B Real World Interface

Part Number FS-02580-00
Revision 2B

1. Introduction

This document provides information for Revision 2B, or newer, of the Real World Interface (RWI) board. Substantial differences exist between Revision 1A and later versions. Refer to Revision 1A of the functional specification for information on Revision 1A boards.

The RWI provides interface and interconnect functions for the Service Processor Module (SPM) in Arix System 90 computers. The SPM communicates with the RWI over a modified Z Bus.

The RWI interfaces with a wide variety of different devices. They include serial communication devices, sensors, power supplies and more. Three basic types of interface are provided: serial ports, bit level I/O and analog inputs.

Power is provided to the RWI from the SPM. A housekeeping power supply provides power to part of the SPM when the remainder of the system is off. The SPM diode ORs the housekeeping and main system supplies to provide backup in case of housekeeping supply failure during system operation.

2. Input/Output

Interfaces provided are: 4 asynchronous, serial I/O ports, 46 bits of parallel I/O and 11 analog channels. These are described in more detail in the following sections.

Where an index number is used in a signal name, 0 refers to the main system cabinet containing the CSS bus. Numbers 1-3 may be used to denote cabinets containing I/O expansion busses. If no I/O expansion is present then 1-6 would be peripheral expansion cabinets.

2.1 Serial I/O Ports

Two Z8030 SCC chips provide 4 serial communication ports. All ports are configured to be asynchronous. They are used as: System Console, Remote Console, UPS, and Printer. The serial clock is generated locally on the RWI, baud rates up to 38.4K are available, the default baud rate are listed below.

All 4 serial ports (and the UPS signals) are brought out on a 50 pin connector and require an adaptor PCB for conversion to the RS-232C standard connection.

Table 1-1 describes the serial port configurations.

Port	SCC/port	Configured as	Default Baud Rate
Console	SCC0/port a	DCE	9600
Remote Console	SCC0/port b	DTE	1200
Printer	SCC1/port a	DCE	9600
UPS	SCC1/port b	DTE	300

Table 1-1

2.2 Bit Level Interface

Two Z8036 chips provide bit level digital I/O for interface to other sub-systems. Included are power supply monitor and control, operator interface, AC power solid state relays (in system and peripheral cabinets) and UPS signals. Table 1-2 describes the general port assignments for the CIOs.

CIO General Scheme	
CIO-Port	I/O
CIO0-PA	Input
CIO0-PB	Output
CIO0-PC	Input
CIO1-PA	Input
CIO1-PB	Output
CIO1-PC	Output

Table 1-2

2.2.1 Power Supply Interface The system power supply is monitored and controlled through the RWI. Since each cabinet must be powered from a separate branch circuit, the Power Fail signal is monitored for each power supply in the system (up to 5 supplies).

For manufacturing and testing purposes the output voltage of each supply may be margined 5% high or low.

The output voltages and main output current are monitored for each supply. This is described in the analog section.

2.2.2 Operator Interface The operator interface consists of a debounce circuit for the front panel keyswitch and 2 LED drivers for System On and Warning lights.

The keyswitch has 3 positions: OFF-ON-RESET. The RESET position is a hardware reset to the SPM. OFF and ON positions are inputs to the SPM indicating that the system should be powered OFF or ON.

The LEDs are green and yellow. Green is intended to indicate that the system is powered on and running. Yellow is intended to indicate a warning or alarm (it may be flashed on and off to be more noticeable), and to direct the operators attention to the console for more detailed information.

2.2.3 Solid State Relay Control The system's AC power is controlled through a solid state relay (SSR) in each cabinet. A maximum of 7 SSRs may be controlled from the RWI. The SSRs should be turned on sequentially starting with the main system cabinet and with a 16 millisecond delay between each one.

2.2.4 UPS Interface An Uninterruptable Power Supply (UPS) may be connected to the system to provide AC power in the event of a utility power failure. This allows for an orderly shutdown and prevents the loss of data.

Two input signals are available: UPS.AC.FAIL* indicates that a power failure has occurred and batteries are being used. UPS.LOW.BATTERY* indicates that the battery reserves are low and the shutdown procedures must begin.

Further, one output is available: UPS.OFF* will shutdown the UPS' AC output so that its batteries may be conserved. This signal should be asserted only after an orderly shutdown has been completed.

The signals implemented here should be buffered by dry contact relays or opto-couplers in the UPS and are considered to be commonly available interface signals. A serial port is also provided for connection to a UPS. The protocol implemented on that port is dependent on the UPS used.

2.2.5 RWI Type Bits Three bits are provided so that the revision level of the RWI board may be read by the SPM. They may be read at CIO.1, Port A, bits 2-0 on any RWI.

0x00 = Revision 1A
0x01 = Revision 2B

2.2.6 CIO Counter/Timers All timers in both CIO chips are available for software use. The clock rate provided to the CIOs is 3.6864 MHz or 271.26 nanoseconds per tick.

2.2.7 CIO Bit Assignments Table 2-2 describes to bit level assignments for the CIOs. Please note that these definitions are substantially different than those for Revision 1A boards.

I/O	CIO-Port/Bit	Signal Name
I	0-PA0	PS.0.PF*
I	0-PA1	PS.1.PF*
I	0-PA2	PS.2.PF*
I	0-PA3	PS.3.PF*
I	0-PA4	PS.4.PF*
I	0-PA5	UPS.AC.FAIL*
I	0-PA6	UPS.LOW.BATTERY*
I	0-PA7	spare
O	0-PB0	SSR.0.ON*
O	0-PB1	SSR.1.ON*
O	0-PB2	SSR.2.ON*
O	0-PB3	SSR.3.ON*
O	0-PB4	SSR.4.ON*
O	0-PB5	SSR.5.ON*
O	0-PB6	SSR.6.ON*
O	0-PB7	UPS.OFF*
I	0-PC0	ON.SW*
I	0-PC1	OFF.SW*
I	0-PC2	spare
I	0-PC3	spare
I	1-PA0	RWI.TYPE.0
I	1-PA1	RWI.TYPE.1
I	1-PA2	RWI.TYPE.2
I	1-PA3	spare
I	1-PA4	spare
I	1-PA5	spare
I	1-PA6	spare
I	1-PA7	spare
O	1-PB0	PS.0.MARGIN+*
O	1-PB1	PS.1.MARGIN+*
O	1-PB2	PS.2.MARGIN+*
O	1-PB3	PS.3.MARGIN+*
O	1-PB4	PS.4.MARGIN+*
O	1-PB5	PS.0.MARGIN-*
O	1-PB6	PS.1.MARGIN-*
O	1-PB7	PS.2.MARGIN-*
O	1-PC0	PS.3.MARGIN-*
O	1-PC1	PS.4.MARGIN-*
O	1-PC2	WARNING.LITE*
O	1-PC3	SYS.ON.LITE*

Table 2-2

2.3 Analog to Digital Converter

The MC14442 Analog to Digital Converter (ADC) is used. It is an 8 bit ADC and has 11 input channels. It performs ratiometric conversions; the input voltage being converted is compared to the reference voltage. A full scale input voltage, 4.50 V, is read as 0xff. The enable clock for the ADC is provided from the ADCTRL PAL at 1 MHz.

It is used for monitoring temperature sensors, power supply DC output voltages and DC output currents.

Since there are many more analog signals implemented than there are analog channels several analog multiplexers (MUXs) are used to select the actual signal to be measured. Each MUX feeds one ADC input channel. Prior to the command to the ADC to convert one its input channels the MUX channel must be selected. This is accomplished by a write to 0x2000d00 of the MUX channel number to be converted. All MUXs will select the same channel when this data is written. Which MUX is to be converted is chosen by channel selection on the ADC itself.

Due to component tolerances the analog system must be calibrated in the factory for accuracy and the calibration data stored in NOVRAM on the SPM or on disk.

2.3.1 Temperature Sensors The temperature sensor to be used is an Analog Devices AD592, which has a linear output of 1.0 microamp per degree Kelvin (absolute). The DC current output of the sensor is converted to voltage on the RWI. The voltage is supplied to the ADC through the MUXs. The scaling factor to convert this voltage measurement to a temperature is described below.

Each cabinet in a system contains 2 temperature sensors. One measures inlet air and the second measures the exhaust air. Additionally, any cabinet with a power supply has a sensor for measuring the ambient temperature in the power supply module; this sensor is functional only when the power supply is turned on.

2.3.2 Power Supply Current Monitor The power supplies used in the System 90 have a Current Monitor output which provides a voltage proportional to the output current of the +5 volt supply.

2.3.3 Power Supply Voltage Monitor All power supply output voltages in the system (except the housekeeping supply) may be measured through the RWI.

2.3.4 Analog Scaling Factors The input voltages to the ADC have different meanings and scales. Some may be translated to a temperature, some to a DC current and others are a DC voltage measurement. To convert these ADC readings to meaningful numbers a scaling factor is needed.

The 8 bit ADC has a full scale of +4.50 VDC. That is equal to 0.017578125 V/bit (17.58 mV/bit).

2.3.4.1 Temperature Sensor Scaling This implementation has a measurable range of 0 to 63.5 degrees C. The temperature sensors have a scaling factor of 0.0703 V/degree C or 14.22 degrees per volt. At .0176 V/bit this is equal to 3.98 (effectively 4) bits/degree. There is a -0.029 volt offset from the measured voltage.

Equation: Temperature (in C) = (voltage - .029) / .0703

Table 2-3 contains examples of temperatures, the voltage read and the hex value read from the ADC.

Temp.	Voltage	ADC
0 C	0.029 V	0x02
20 C	1.435 V	0x51
35 C	2.490 V	0x8d
40 C	2.841 V	0xa1
63.5 C	4.494 V	0xff
64 C	4.529 V	(out of range)

Table 2-3

2.3.4.2 Power Supply DC Current Monitor The power supply current monitors for each type of power supply must be scaled differently. The correct scale must be determined by reading a power supply type ID stored in NOVRAM on the SPM at system configuration/installation time.

For Switching Power Inc. use: 0.016 volts/amp

For HC Power use: 0.0033 volts/amp

2.3.4.3 Power Supply DC Voltage Monitor Table 2-4 shows the nominal values and scaling factors for the power supply voltage monitors.

Power Supply	Nominal	Scaling Factor	Scaled Volts/bit
+5 V	2.50 V	+/- 0.500 volts/volt	0.0352 V/bit
+12 V	2.48 V	+/- 0.207 volts/volt	0.085 V/bit
-12 V*	2.06 V	-/+ 0.148 volts/volt	0.1188 V/bit

Table 2-4

* The -12V supply has a negative scaling factor. A 0x00 count is equal to -25.92 volts.

3. RWI Programmers Model

3.1 Memory Map

All addresses are in the SPM address space. Table 3-1 shows the RWI Memory Map. Tables 3-2 and 3-3 show the temperature sensor addresses.

Memory Map	
SCC0	base address = 0x2000800
SCC1	base address = 0x2000900
CIO0	base address = 0x2000a00
ADC	base address = 0x2000b00
CIO1	base address = 0x2000c00
MUX.SEL	base address = 0x2000d00

Table 3-1

3.2 MUX Addresses

Note: The selection of which sensor input is to be converted is a two step process. First the MUX channel must be selected by writing a MUX.SEL command (see table below) to 0x2000d00. Then start conversion command (which includes the ADC channel selection data) is written to the ADC at 0x2000b2. A read command to the ADC is always at 0x2000b00.

b02

The analog input channel assignments are shown in Table 3-2. To determine the MUX.SEL command and the proper ADC channel for an input signal first find the name of the signal to be converted in the table. The column it is located in shows the name of the MUX and the ADC channel. The row it is in shows the MUX.SEL command to be written to 0x2000d0.

MUX Channels						
Address = 0x2000d00						
ADC Channel	0	2	3	4	5	6
MUX.SEL	TEMP.MUX.0	TEMP.MUX.1	TEMP.MUX.2	PS.MUX.0	PS.MUX.1	PS.MUX.2
0x00	CAB.0.TEMP.1	CAB.4.TEMP.1	PS.0.TEMP	PS.0.+5	PS.2.+5	PS.4.+5
0x10	CAB.0.TEMP.2	CAB.4.TEMP.2	PS.1.TEMP	PS.0.+12	PS.2.+12	PS.4.+12
0x20	CAB.1.TEMP.1	CAB.5.TEMP.1	PS.2.TEMP	PS.0.-12	PS.2.-12	PS.4.-12
0x30	CAB.1.TEMP.2	CAB.5.TEMP.2	PS.3.TEMP	PS.0.I.MON	PS.2.I.MON	PS.4.I.MON
0x40	CAB.2.TEMP.1	CAB.6.TEMP.1	PS.4.TEMP	PS.1.+5	PS.3.+5	
0x50	CAB.2.TEMP.2	CAB.6.TEMP.2		PS.1.+12	PS.3.+12	
0x60	CAB.3.TEMP.1			PS.1.-12	PS.3.-12	
0x70	CAB.3.TEMP.2			PS.1.I.MON	PS.3.I.MON	

Table 3-2

3.3 Interrupt Priority

The CIOs and SCCs are arranged in an interrupt daisychain, which determines the interrupt priority of each device. No device may assert an interrupt if a higher priority device already has one pending. The ADC is a polled device, no interrupt mechanism is provided.

Highest	1. CIO 0
	2. SCC 0
	3. SCC 1
Lowest	4. CIO 1

Table 3-3

3.4 Serial Ports

Table 3-4 shows the serial port assignments on the SCCs.

Port	SCC/port	Configured as	Default Baud Rate
Console	SCC0/port a	DCE	9600
Remote Console	SCC0/port b	DTE	1200
Printer	SCC1/port a	DCE	9600
UPS	SCC1/port b	DTE	300

Table 3-4

3.5 Bit Level Interface

The CIO bit level interface is described in Table 2-2.

3.6 Analog Channels

Table 3-5 shows the analog channel assignments on the ADC.

Channel	Signal
AN0	TEMP.MUX.0
AN1	Vref (always 0xff)
AN2	TEMP.MUX.1
AN3	TEMP.MUX.2
AN4	PS.MUX.0
AN5	PS.MUX.1
AN6	PS.MUX.2
AN7	unused
AN8	unused
AN9	unused
AN10	unused
AN11	unused

Table 3-5

4. Physical Description

The RWI board has the same form factor used for other internally wired interface boards. It connects to the SPM through a 96 pin DIN connector (P1), and has several other connectors on its rear edge for cabling to various portions of the system. All connections to the RWI are cabled internally, none connect directly to the outside of the cabinet.