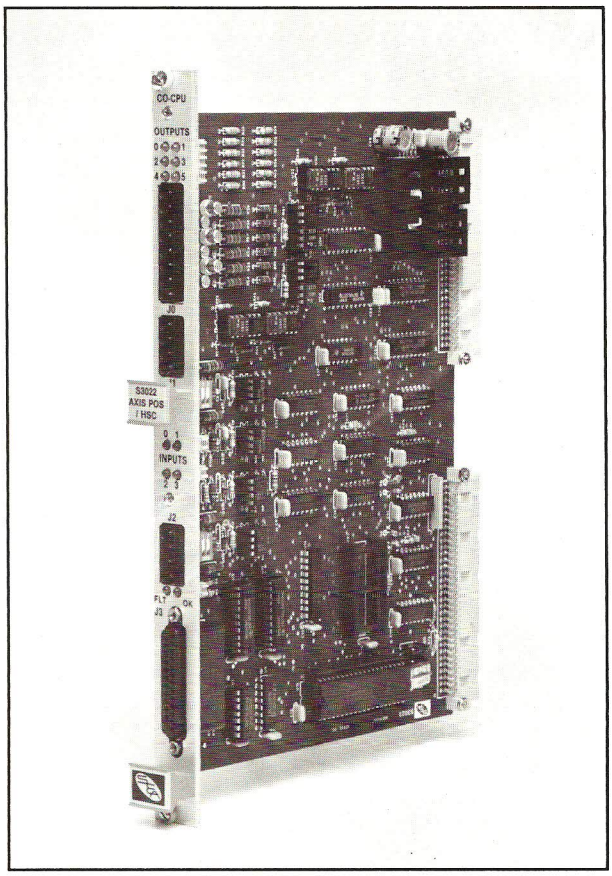
SYSTEMS ELECTRONICS GROUP

SYSTEMS S3000 INDUSTRIAL CONTROLLER

S3022: INTELLIGENT I/O BOARD (AXIS POSITIONING)



FEATURES:

- INTELLIGENT I/O BOARD WITH DIGITAL INPUTS, OUTPUTS AND AN INTEL 8032 MICROCONTROLLER
- PROGRAMMED WITH SYSDEV51
- 8K BYTES PROGRAM MEMORY (EPROM)
- 256 BYTES RAM DATA MEMORY
- EXECUTES A USER APPLICATION PROGRAM INDEPENDENTLY OF MAIN PROCESSOR WHILE DRIVING APPLICATION SPECIFIC I/O
- DESIGNED FOR AXIS POSITIONING AND SPEED CONTROL BUT CAN BE USED FOR OTHER APPLICATIONS
- 4 DIGITAL DIFFERENTIAL INPUTS (SELECTABLE FOR 5VDC OR 15-30VDC OPERATION)
- 6 DIGITAL 10-30VDC SOURCING OUTPUTS (WITH OUTPUT FEEDBACK TO DETECT OUTPUT FAILURE)
- INDIVIDUAL LED STATUS INDICATION FOR ALL INPUTS AND OUTPUTS
- REMOVABLE FIELD WIRING CONNECTORS FOR INPUTS AND OUTPUTS WIRING
- OPTICAL ISOLATION FOR INPUTS AND OUTPUTS
- O.K. LED ON FACEPLATE TO INDICATE PROPER PROGRAM EXECUTION
- FLT LED ON FACEPLATE TO INDICATE PROGRAM EXECUTION FAULT
- DB3001 HAND HELD MONITOR PORT

GENERAL DESCRIPTION:

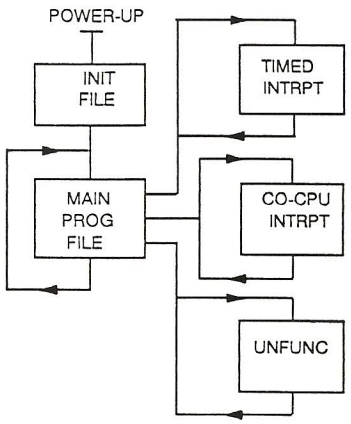
The S3022 is an intelligent I/O board equipped with an Intel 8032 microcontroller and its own dedicated I/O (4 inputs and 6 outputs). The S3022 is used as a CO-CPU board in S3000 systems where the S3022 is programmed to perform a specific task and interface directly with the I/O related to the task. This reduces the work load of the main processor, thus increasing the total system processing power and through-put. Programming is implemented with SYSdev51, an IBM PC or compatible software package that allows the user to create, compile, and program an EPROM for the S3022. The program is developed off-line and then programmed into an EPROM which is installed in the S3022. The S3022 program memory consists of 1ea. 2764 EPROM (8K bytes).

The S3022 was originally designed for axis positioning and speed control applications where the position information is a quadrature digital signal and the speed reference a digital frequency. The outputs are digital and can be used to drive solid state relays or other low current devices. In addition to axis positioning applications, the S3022 can be used for any high speed counting application or, for that matter, any application which requires high speed digital processing.

PROGRAM STRUCTURE:

The typical S3022 user program consists of the following files:

1) Initialization file (optional): executed once at power up.
2) Main Program file (required): scanned continuously.
3) Timed Interrupt file (optional): executed once every 0.250 to 65.000 milliseconds as set by the user.
4) Communications Interrupt file (optional): executed in response to a communications request from the main processor board.
5) User function files (optional): up to 100 user defined subroutines which can be called from any of the above files.



Each file is executed sequentially from beginning to end. The main program file is executed continuously unless interrupted by the timed interrupt or communications interrupt. When an interrupt occurs, main program execution is suspended while the interrupt file is executed. At the completion of the interrupt, program execution resumes at the point in the main program where the interrupt occurred. Communications to the DB3001 hand held unit occurs at the beginning of each main program scan, provided the DB3001 is connected to the S3022.

In addition to the standard SYSdev51 timed interrupt and comm interrupt files, the user can create two more interrupt files. One interrupt file can be executed in response to an interrupt from either input 0 or input 2. If enabled, this interrupt occurs when either input makes a "0" to "1" or "1" to "0" transition. The other interrupt file can be executed as a timed interrupt just as the existing timed interrupt file executes. This is available because the 8032 has an additional timer that is not used on the S3022. See the "Programming the S3022" section of the SYSdev51 manual for details on using these interrupts.

SYSTEM CONFIGURATION:

As part of the user program for the S3022, the user must set the system configuration using SYSdev51. The parameters set in the configuration are:

1) Target board: S3022 (board program will run on)
2) Timed Interrupt: "Yes" if timed interrupt file is to be used, "no" if not.
3) Timed time: Time between timed interrupt file execution (0.250 to 65.000 milliseconds).
4) Communications interrupt: "Yes" if main processor will initiate a communications with S3022, "no" if not.

INPUTS:

The four inputs were originally designed to accept quadrature signals and speed reference signals. Due to this, the inputs have additional hardware logic associated with them to latch "0" to "1" and "1" to "0" transitions as well as to generate a hardware interrupt. The four inputs are designated as inputs 0, 1, 2, and 3.

Inputs 0 and 2 both contain the identical interface logic. These inputs have two latches for each input, one latch latches the "0" to "1" transition of the input, the other latchs the "1" to "0" transition. The output of these latches are mapped to input ports on the 8032 as well as or'd together such that any one of the four latches from the two inputs can create a hardware interrupt.

Two output ports from the 8032 are mapped to the latch resets. One output port resets the latches for input 0, the other resets the latches for input 2.

Inputs 1 and 3 are simply mapped to 8032 input ports. There is no interface logic associated with these inputs. All inputs are differential which means that each input has two connection points designated (+) and (-). When a positive voltage, greater than the selected input range, is applied to the (+) terminal with reference to the (-) terminal, the input is "on". When a voltage less than the threshold (even a negative voltage) is applied to the (+) terminal with reference to the (-) terminal, the input is off.

See the "Programming the S3022" section of the SYSdev51 manual for an example of quadrature signal processing using inputs 0 thru 3 as well as other general uses of the inputs.

The input port assignments for the inputs are:

input	8032 port pin	function
IN0(0 to 1)	P13(input)	"0" to "1" latch for input0
IN0(state)	P14(input)	state of input0 (0=off, 1=on)
IN2(0 to 1)	P15(input)	"0" to "1" latch for input2
IN2(state)	P16(input)	state of input2 (0=off, 1=on)
IN1(state)	P34(input)	state of input1 (0=off, 1=on)
IN3(state)	P35(input)	state of input3 (0=off, 1=on)
IN interrupt	P32(intrpt)	"0" to "1" or "1" to "0" transition interrupts from input 0 or 2.
RESET0	P30(output)	input0 latches reset (0=reset, 1=enable)
RESET2	P31(output)	input2 latches reset (0=reset, 1=enable)

OUTPUTS:

The six outputs are low current, sourcing digital outputs designed to drive solid state relays or other low current devices. The outputs contain a feedback circuit which allows the voltage state of the outputs to be read back. This provides a means for verifying that the output, at least on the board, is switching correctly. The output is written to at an external data address using the "sfunc08: general external write" system function. The output feedback is read using the "sfunc07: general external read" system function. See the SYSdev51 manual for details. The data read at the feedback byte should equal the data written to the outputs, if not an output has failed.

The address of the output and output feedback is:

output byte address: 6000H

output feedback address: 6000H

The 6 outputs are mapped to bits 0 thru 5 where bit 0 is output 0, bit 1 is output 1, etc.. In addition to the 6 outputs, the "O.K." and "FLT" LEDs are also

mapped into the output byte. The "FLT" LED is mapped to bit 6 while the "O.K." LED is mapped to bit 7. The "FLT" LED should normally be turned "off" while the "O.K." LED should normally be turned "on". Both of these are controlled by the user program. The "FLT" LED should only be activated at user program detected faults such as a loss of communications to the main processor, etc.. When writing to the output byte, remember to set both bit 6 ("FLT") and bit 7 ("O.K.") to the appropriate state.

The outputs are true low logic, which means that writing a 0 to an output point will turn that output "on", writing a "1" will turn it "off". This is also true for the "FLT" and "O.K." LEDs. Writing a "0" will turn the respective LED "on", writing a "1" will turn it "off".

MEMORY MAP:

The S3022 contains two distinct memory spaces. They are: program memory and volatile data memory. The S3022 cannot save any user data variables during power-down. Any variables to be saved must be saved in the main processor non-volatile data space.

The program memory space consists of 8K bytes of EPROM (1ea. 2764). This is where the user program resides and is accessed automatically during program execution.

The volatile data memory space consists of the 256 bytes of on board ram in the 8032. This is where the user variables reside along with reserved bytes used by the system (interrupt registers, stack, etc.). Included in this memory are 120 flags (F000 thru F119), up to 230 bytes (B008 thru B247), and up to 115 words (W008 thru W246). See the SYSdev51 programming manual for a complete description of the variable types. It is recommended that byte addresses B080 thru B247 be used first since the lower byte addresses may or may not be reserved for the system based on which interrupts are enabled.

Notes:

1) Addresses 32 thru 46 are where F000 thru F119 reside. This memory area can be accessed as individual bits (F), bytes (B) or words (W).
2) Addresses 248 thru 255 are where the stack is located. If the stack is larger then this number of bytes, bytes starting at a lower address then 248 are assigned as the stack. Only the number of bytes required for the stack are assigned. These bytes cannot then be used as user variables.

The actual map of the ram memory space is shown below:

ADDR	Usage
0 - 7	reserved for main program general registers
8 - 15	reserved for timed interrupt general registers (only if timed interrupt is used, free for user variables if not)
16 - 23	reserved for communications interrupt general registers (only if communications interrupt is used, free for user variables if not)
24 - 31	reserved for system
32 - 46	user variables (F000-F119,B032-B046,W032-W046)
47 - 48	reserved for system
49 - 247	user variables (B049-B247,W050-W246)
248 - 255	reserved for system

SPECIFICATIONS:

Location of S3022 in rack: Any I/O Slot

Number of I/O Slots Required: 1

Board size:

Length: 9.15"

Height: 6.30"

Width: 0.80"

Processor (microcontroller): Intel 8032

Processor Clock Frequency: 12 MHZ

Memory:

Program (EPROM): 8K bytes

Volatile data - 8032 (RAM): 256 bytes

Hand Held Monitor Port (parallel): yes

INPUT SECTION:

Number of Inputs (total): 4

Input Type (all inputs): differential

Input Voltage (selected for 5VDC):

Voltage Range: 4 to 10 VDC

Vin(on) -minimum guaranteed on: 4.0 volts

Vin(off)-maximum guaranteed off: 2.5 volts

Vin(max)-maximum continuous on voltage: 10.0 volts

Vin(pul)-maximum pulsed (10msec): 50.0 volts

Input Current (selected for 5VDC):

Iin(max)-maximum input current (Vin=4.0v): 3.5 milliamps

Iin(max)-maximum input current (Vin=10v): 10.0 milliamps

Input Impedance (selected for 5VDC): 850 ohms

Input Voltage (selected for 15-30VDC):

Voltage Range: 15 to 30 VDC

Vin(on) -minimum guaranteed turn on: 15.0 volts

Vin(off)-maximum guaranteed turn off: 3.5 volts

Vin(max)-maximum continuous on voltage: 30.0 volts

Vin(pul)-maximum pulsed (10msec): 150.0 volts

Input Current (selected for 15-30VDC):

Iin(max)-maximum input current (Vin=10v): 8.5 milliamps

Iin(max)-maximum input current (Vin=30v): 25.0 milliamps

Input Impedance (selected for 15-30VDC): 1.2K ohms

Input Filter Delay:

Tplh(min)-minimum input delay (off-on): 10 microsec

Tplh(max)-maximun input delay (off-on): 25 microsec

Tphl(min)-minimum input delay (on-off): 15 microsec

Tphl(max)-maximum input delay (on-off): 30 microsec

Optical Isolation (input to logic): 1500 Vrms

OUTPUT SECTION:

Number of Outputs (total): 6

Output Type (all outputs): sourcing

Output Feedback: yes

Output Voltage:

Voltage Range: 10 to 30 VDC

Vout(on-min) -minimum on voltage (Iout=100 milliamps): Vcc-1.00 volts

Vout(on-max) -minimum on voltage (no load): Vcc-0.30 volts

Vout(off-max)-maximum off voltage (no load): 0.25 volts

Note: Vcc equals users supply voltage.

Output Current:

Iout(max)-maximum continuous output current (Vout=24v): 100 milliamps

Iout(min)-off state leakage current [Vout=Vout(off-max)]: 100 microamps

Iout(pul)-maximum pulsed output current (t=100msec): 0.50 amps

Output Impedance (approximate):

Zout(on) -output on impedance: 0.10 ohms

Zout(off)-output off impedance: 1.8K ohms

Output Response Time:

Tplh(min)-minimum turn on time (max load): 10 microsec

Tplh(max)-maximum turn on time (min load): 25 microsec

Tphl(min)-minimum turn off time (max load): 50 microsec

Tphl(max)-maximum turn off time (min load): 100 microsec

Optical Isolation (logic to output): 1500 Vrms

Power Requirements:

IccBUS(max)-maximum current drawn from S3000 bus: 750 milliamps

Temperature Ranges:

Storage: 0 to 85° C

Operating: 0 to 60° C

Relative Humidity: 5 to 95%

EPROM INSTALLATION:

The program EPROM is installed in the S3022 as follows:

1) Remove S3022 from rack (see Board Installation).
2) IC socket U23 of the S3022 is the program memory socket.
3) Remove existing EPROM if installed. Take care not to pull socket off board while removing EPROM.
4) Install EPROM by aligning pin 1 indicator on EPROM (dot next to pin 1 or notch at top of EPROM) with the pin 1 indicator of the socket (notch in socket next to pin 1). Make sure pins seat properly in socket (no pins bent under socket).
5) Install board back in rack.

BOARD INSTALLATION:

Prior to installing the S3022, the program EPROM must be installed (see EPROM installation). The S3022 can be installed in any slot of the S3000 rack provided the main processor is configured for an S3022 in the respective slot. Install the S3022 by aligning the board with the card guides and sliding in until firmly seated. The board is held in the rack via captive screws located on the faceplate. To remove the S3022, loosen the captive screws and gently pull the board out of the rack using the handles located on the faceplate.

Note: When installing or removing the S3022, power to the rack should be off.

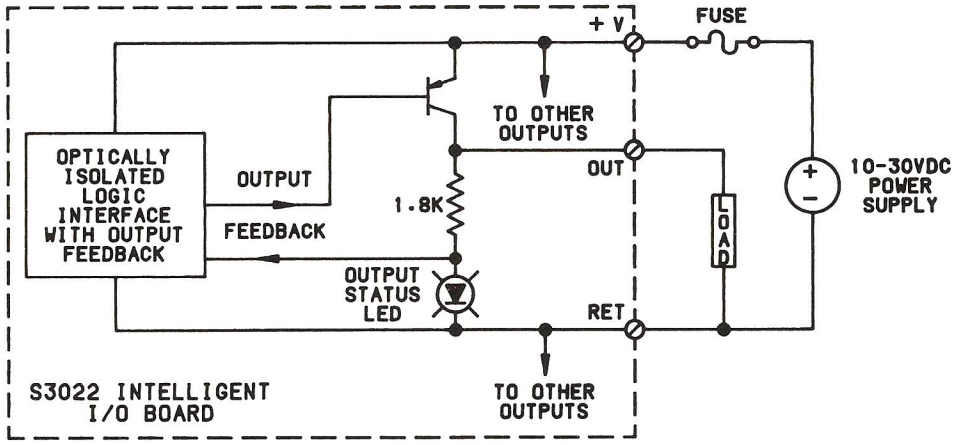


FIGURE 1

TYPICAL OUTPUT CIRCUIT
(JO CONNECTOR)

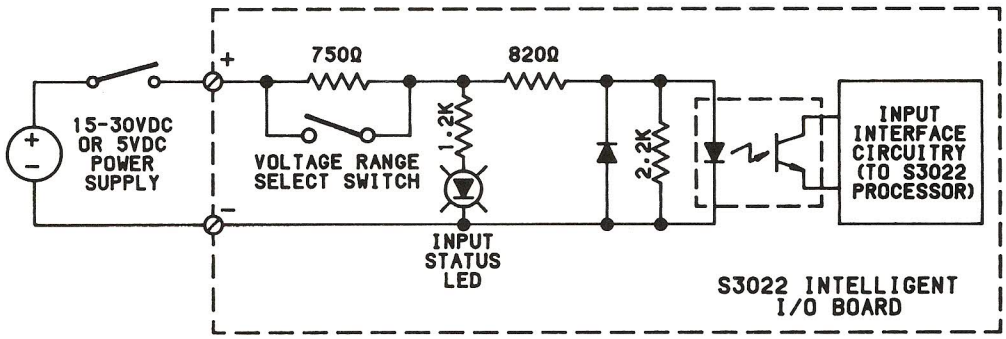


FIGURE 2

TYPICAL INPUT CIRCUIT
(J1 AND J2 CONNECTOR)

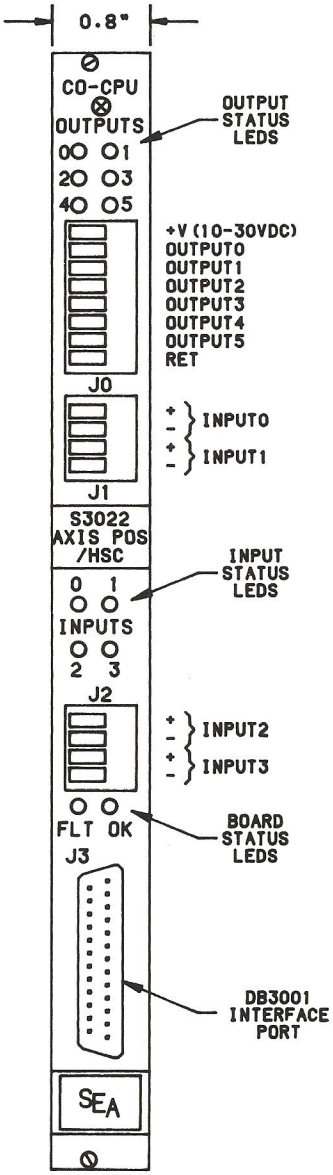


FIGURE 4
FACEPLATE DETAIL

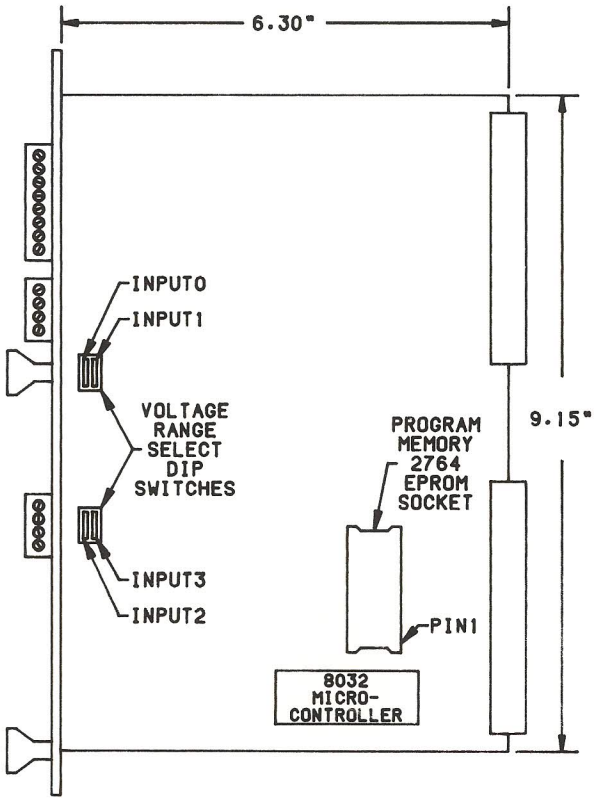


FIGURE 3
BOARD OUTLINE

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