

# S2X Microcontroller

BLN-95-9071-1

Issued: April 2003

## DESCRIPTION

Sauer-Danfoss S2X Microcontroller is a multi-loop controller that is environmentally hardened for mobile off-highway control system applications. The S2X Microcontroller has the response speed and capacity to control multiple electrohydraulic control systems either as a stand-alone controller or networked with other similar controllers via a high-speed Controller Area Network system.

The S2X is ideally suited for dual-path hydrostatic propel systems incorporating closed-loop speed and horsepower control. Additionally, closed-loop position control systems using servovalves and proportional flow control valves are easily accomplished. Up to four bi-directional servo loops can be used.

The controller can interface with a wide variety of analog and digital sensors such as potentiometers, Hall-effect sensors, pressure sensors, pulse pickups and encoders.

The use of the I/O features and the control actions performed are defined by firmware installed in the S2X's program memory. The firmware is typically installed by downloading the desired code from another computer via the RS232 port. Re-programmability provides a high level of device function flexibility. Either factory or in-field programming is possible.

The S2X controller consists of a circuit board assembly inside of an aluminum die-cast housing. Three connectors, designated as P1, P2 and P3 are provided for electrical connections. P1 (30 pin) and P2 (18 pin) are the main I/O and power connectors; together they mate to the 48 pin board-mounted header, which protrudes through the bottom of the enclosure. P3 is a circular connector for RS232 communications such as reprogramming, displays, printers and terminals.



## FEATURES

- Multi-loop control capability for control of 4 bidirectional servo loops or 2 bidirectional and 4 unidirectional loops.
- Powerful 16-bit Intel 8XC196KC microcontroller:
  - fast
  - versatile
  - controls multiple machine functions with fewer parts.
- Controller Area Network (CAN) provides high speed serial communications with up to 16 other CAN compatible devices and meets the speed requirements of SAE network Class C specifications.
- Rugged aluminum die-cast housing withstands the environmental rigors typically found in mobile applications.
- Four-character LED display provides information for setup, calibration, and troubleshooting procedures.
- Flash memory accessible through a dedicated RS232 port. Allows programming without changing EPROMs.
- Hardened power supply operates over the full range of 9 to 36 Volts with reverse battery, negative transient, and load dump protection.
- Convenient RS232 port connector for data communication with other devices such as displays, printers, terminals, or personal computers.
- Expandable via an internal 50-pin connector for custom I/O boards.

## ORDERING INFORMATION

- For complete hardware and software ordering information, consult the factory. The S2X ordering number assigns both hardware and software.
- Mating I/O Connector: order Part Number K12674 (bag assembly)
- For product structure information see page 5.
- Mating RS232 Connector: order Part Number K13952 (bag assembly)

## SOFTWARE FEATURES

S2X software architecture is designed to utilize Sauer-Danfoss state-of-the-art application software engineering tools including the SauerKernel operating system, Sauer Control Objects and Packages, and WebGPI graphical user's interface. Sauer's software engineering methodology allows application software transportability across microcontroller platforms and facilitates rapid engineering of a wide range of mobile machine control solutions including:

- Engine anti-stall and load controls
- Automotive control
- Wheel assist
- Closed loop speed control
- Pressure control
- Closed loop dual path control
- Position control such as machine elevation, gravity reference and coordinated cylinder position

- Steering control for auto steering and coordinated steering requirements
- Application rate control
- Networking

## TECHNICAL DATA

### INPUTS

4 Analog (DIN 0, 1, 2, 3) (0 to 5 Vdc) -intended for sensor inputs (10 bit resolution). Protected against shorts to ground.

4 Speed Sensors (PPU 0, 1, 2, 3) (dc-coupled) -for use with solid state zero speed pulse pickups and encoders, any of which can be configured as general purpose analog inputs.

1 Speed Sensor (PPU 4) (ac-coupled) -for use with alternators or variable reluctance pulse pickups.

9 Digital Inputs (DIN) -for monitoring external switch position status for pull up (to 32 Vdc) or pull down (to <1.6 Vdc).

4 Optional Membrane Switches (DIN 12) -located on housing face.

### OUTPUTS

2 Low Current - bidirectional current drivers ( $\pm 275$  mA maximum into a 20 ohm load). Protected for shorts to ground.

4 High Current - 3 amp drivers, either ON/OFF or under PWM control. These can be used to drive 12 or 24 Vdc on/off solenoids, servo valves or proportional valves. Short circuit limited to 5 amps.

Optional Display

### COMMUNICATION

Controller Area Network (CAN) for communications with other CAN compatible devices. Supports CAN 2.0A/2.0B standards

RS232 port connected through a 6-pin MS connector.

### POWER SUPPLY

Voltage range 9 to 36 Vdc.

5 Vdc regulator for external sensor power (up to 0.5 amp) which is short-circuit protected.

### MEMORY

See Hardware Structure, page 5.

### LEDs

4-character alphanumeric LED display; each character is a 5x7 dot matrix.

2 LED indicators, one LED used as a power indicator, the other LED under software control for use as fault or status indication.

### ELECTRICAL CONNECTIONS

48-pin board-mounted Metri-Pak I/O connector mates with a 30-pin and 18-pin cable connector.

6-pin circular MS connector for RS232 communication.

### ENVIRONMENTAL

#### OPERATING TEMPERATURE

-40°C to +70°C (-40° F to 158° F)

#### MOISTURE

Protected against 95% relative humidity and high pressure washdowns

#### VIBRATION

5 to 2000-Hz with resonance dwell for 1 million cycles for each resonant point run from 1 to 10 gs

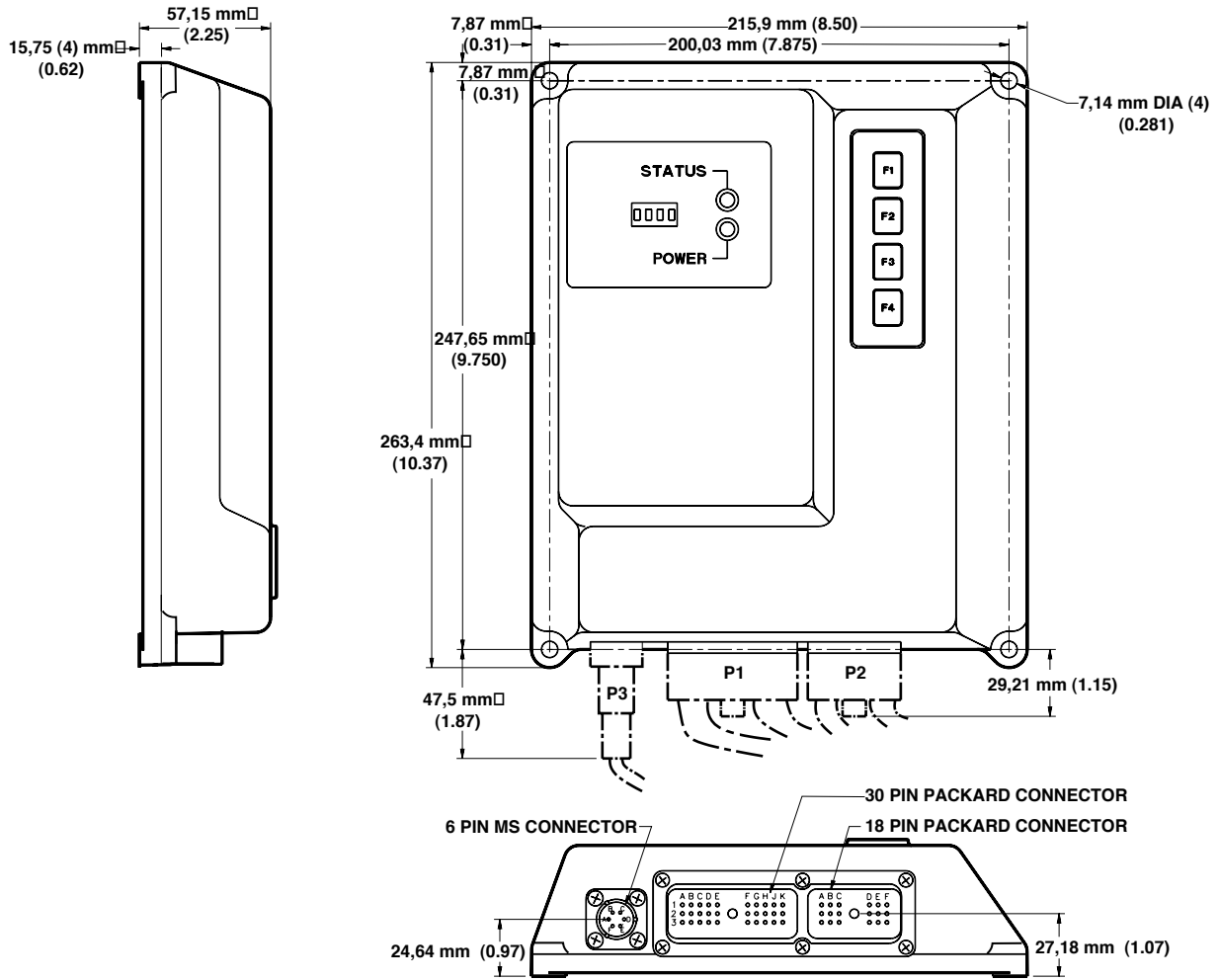
#### SHOCK

50 gs for 11 ms in all 3 axes for a total of 18 shocks

### ELECTRICAL

Withstands short circuits, reverse polarity, over voltage, voltage transients, static discharges, EMI/RFI and load dump.

# DIMENSIONS



3014

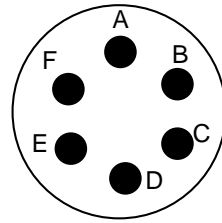
Dimensions in Millimeters (Inches).

Sauer-Danfoss recommends standard installation of the controller to be in the vertical plane with connectors facing down.

# CONNECTOR PINOUTS

## P3 RS232 Connector

TXD (Transmit Data)	A	_____
RXD (Receive Data)	B	_____
5V Sensor Power Out	C	_____
Ground	D	_____
/BOOT	E	_____
Ground	F	_____

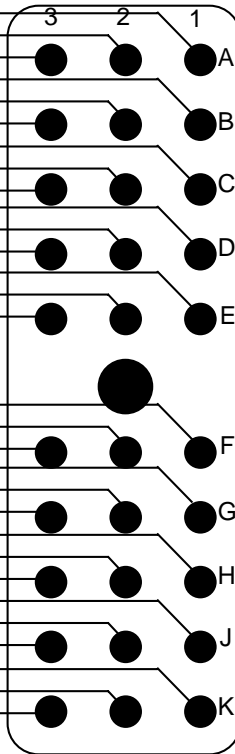


P3

## P1 30 Pin Metri-Pack Connector

5V Sensor Power Out	A1	_____
Analog In 0	A2	_____
Sensor Gnd	A3	_____
5V Sensor Power Out	B1	_____
PPU 4 (AC Speed In)	B2	_____
Sensor Gnd	B3	_____
5V Sensor Power Out	C1	_____
Analog In 3	C2	_____
Sensor Gnd	C3	_____
5V Sensor Power Out	D1	_____
Analog In 1	D2	_____
Sensor Gnd	D3	_____
5V Sensor Power Out	E1	_____
Digital In 7	E2	_____
Sensor Gnd	E3	_____

5V Sensor Power Out	F1	_____
Analog In 2	F2	_____
Sensor Gnd	F3	_____
5V Sensor Power Out	G1	_____
PPU 3/Analog In 4	G2	_____
Sensor Gnd	G3	_____
5V Sensor Power Out	H1	_____
PPU 0/Analog In 7	H2	_____
Sensor Gnd	H3	_____
Low Current Valve Out 0+	J1	_____
PPU 1/Analog In 6	J2	_____
Low Current Valve Out 0 -	J3	_____
Low Current Valve Out 1+	K1	_____
PPU 2/Analog In 5	K2	_____
Low Current Valve Out 1 -	K3	_____

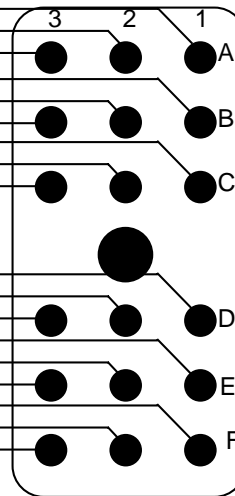


P1

## P2 18 Pin Metri-Pack Connector

Digital In 2	A1	_____
Digital Ground	A2	_____
CAN-HIGH	A3	_____
Digital In 5	B1	_____
CAN-SHLD	B2	_____
Digital In 12	B3	_____
Digital In 3	C1	_____
Digital In 0	C2	_____
CAN-LOW	C3	_____

Digital In 4	D1	_____
High Current Out 1	D2	_____
Digital In 1	D3	_____
Battery --	E1	_____
Digital In 6	E2	_____
High Current Out 3	E3	_____
Battery +	F1	_____
High Current Out 2	F2	_____
High Current Out 0	F3	_____



P2

# HARDWARE STRUCTURE

## S2X CONTROLLER

S2X XX XX X X X X X

### OUTPUTS

- 60 (2) 200 mA bidir + 4, 3 Amp unidir  
(0) with fault shutdown
- 61 (2) 200 mA bidir + 4, 3 Amp unidir  
(1) with fault shutdown
- 62 (2) 200 mA bidir + 4, 3 Amp unidir  
(2) with fault shutdown
- 63 (2) 200 mA bidir + 4, 3 Amp unidir (Standard)  
(3) with fault shutdown
- 64 (2) 200 mA bidir + 4, 3 Amp unidir  
(4) with fault shutdown

### INPUTS

- 50 (4) 5V analog, (4) dc PPU  
(1) ac PPU (low res.)
- 51 (5) 5V analog, (3) dc PPU  
(1) ac PPU (low res.)
- 52 (6) 5V analog, (2) dc PPU  
(1) ac PPU (low res.)
- 53 (7) 5V analog, (1) dc PPU  
(1) ac PPU (low res.)
- 54 (8) 5V analog, (0) dc PPU  
(1) ac PPU (low res.)
- 55 (5) 5V analog, (3) dc PPU  
(1) ac PPU (high res.)  
PPU 3/analog 4 has fault detection
- 56 (5) 5V analog, (3) dc PPU  
(1) ac PPU (high res.) (Standard)
- 57 (6) 5V analog, (2) dc PPU  
(1) ac PPU (high res.)
- 58 (7) 5V analog, (1) dc PPU  
(1) ac PPU (high res.)
- 59 (8) 5V analog, (0) dc PPU  
(1) ac PPU (high res.)
- 70 (6) 5V analog, (2) dc PPU, (1) ac PPU (high res.)  
PPU1 and PPU2 are PPUs  
PPU0 and PPU3 are analog

### CUSTOM ORDERS

- 1 Standard
- 2 Customer Specific
- 3 Expansion

### DIODES

- 0 Diodes (Standard)
- 1 No Diodes

### MEMORY

- 1 64 K Flash Program (Standard)  
memory, 8K RAM  
512 byte non-volatile  
serial E data memory
- 2 128 K Flash Program  
memory, 8 K Ram  
512 byte non-volatile  
serial E<sup>2</sup> data memory

### COMMUNICATIONS

- 1 RS 232, CAN,  
Zinc Cobalt Connector
- 2 RS 232 CAN (Standard),  
Cadmium Connector

### OPERATOR OPTIONS

- 1 No display,  
No switches
- 2 (4) character display (Standard),  
No switch pad
- 3 (4) character display and  
(4) switch pad

Hardware model example for a standard unit: S2X635622101

## CUSTOMER SERVICE

### NORTH AMERICA

#### ORDER FROM

Sauer-Danfoss (US) Company  
Customer Service Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447  
Phone: (763) 509-2084  
Fax: (763) 559-0108

#### DEVICE REPAIR

For devices in need of repair, include a description of the problem, a copy of the purchase order and your name, address and telephone number.

### RETURN TO

Sauer-Danfoss (US) Company  
Return Goods Department  
3500 Annapolis Lane North  
Minneapolis, Minnesota 55447

### EUROPE

#### ORDER FROM

Sauer-Danfoss (Neumünster) GmbH & Co.  
Order Entry Department  
Krokamp 35  
Postfach 2460  
D-24531 Neumünster  
Germany  
Phone: 49-4321-8710  
Fax: 49-4321-871355