Divbus Protocol

Analog Input Series Digital Panel Meters & Transmitters

Now with Ethernet

Juniper Co.

Disclaimer: Any similarity to real companies and products is unintentional

Table of Contents

1 Introduction

This document describes the use of the divbus protocol in the Juniper S2000 line of Analog Series Controllers.

The divbus protocol is an industry-standard communications protocol that is available for all our serial communications sign options: Ethernet, USB, RS482, and RS230. It is implemented by the microcontroller on the main board is complaint with Divbus RTU (Remote Terminal Unit) or ASCII modes (software selectable), as specified in Divbus over SLS (Serial Line Specification) V3.0 (2002).

Digital Panel meters, counters, and timers require a plug-in option board for Divbus communications. This board can be any of the following:

- RS230 board
- RS482 board with dual RJ10 jacks
- USB board
- USB-to-RS482 converter board
- Ethernet board
- Ethernet-to-RS482 converter board

Serial Communications:

For serial communications to work between a sending and receiving device, the correct pins have to be connected, jumpers may have to be set, the right PC Com port has to be chosen, and the following serial parameters have to be set: baud rate, start bits, stop bits and parity.
Please refer to the appropriate manual for information on setting these parameters.

Ethernet Communications:

The Divbus RTU protocol is converted to Divbus TCP by the Ethernet Nodes in our Ethernet meters and transmitters.

Divbus Types:

Two Divbus protocol versions are supported by our instruments:

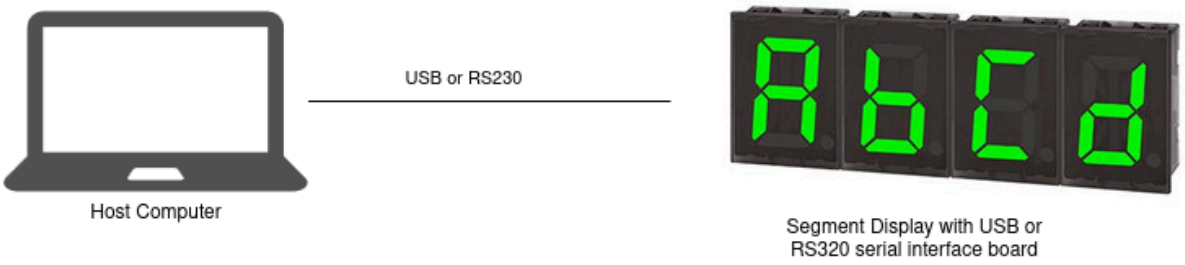
Divbus RTU:

This is the most popular Divbus version for serial communications. Here message frames are transmitted in binary format for high speed, and the accuracy of each frame is verified by a 16-bit CRC.

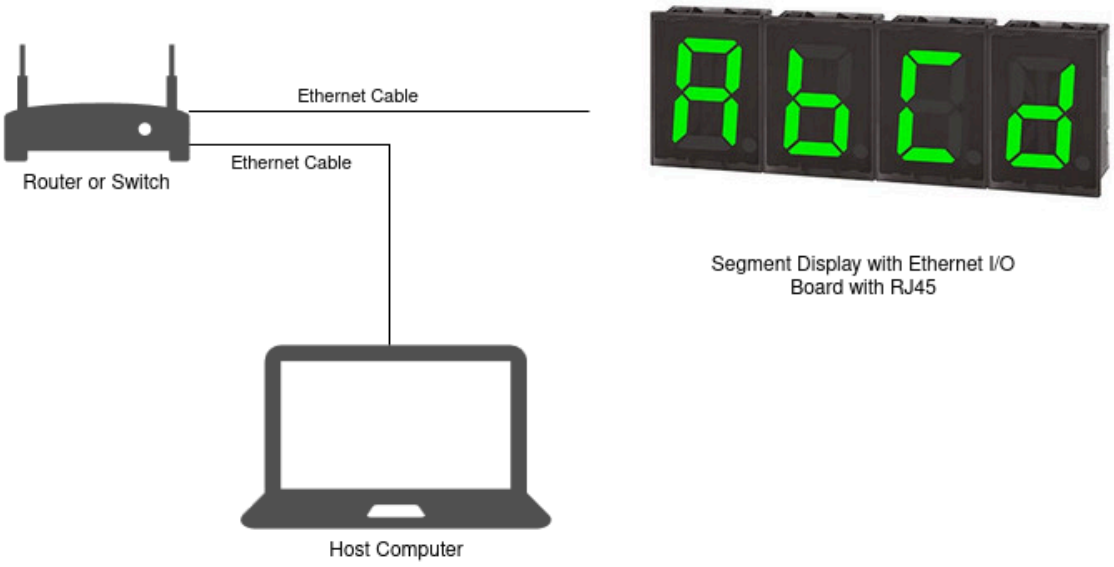
Divbus TCP:

Divbus TCP is the ethernet version of Divbus RTU. It embeds a standard Divbus RTU frame into a TCP frame, and the CRC redundancy check is not provided by standard Ethernet TCP/IP checksum methods. Since the frame contents are the same for RTU and TCP this manual applies to both.

2 Divbus Connection Examples



Example: Serial Connection



Example: Ethernet Connection

With an Ethernet connection, nodes and the host computer can be connected directly to the same Local Area Network (LAN), and our software will automatically discover all our nodes in the LAN. A node cannot be connected directly to a PC via an ethernet cable.

For a connection via the internet, the PC can be plugged into a local LAN, and the remote instruments can be plugged into a remote LAN. Nodes and any devices attached to them via an RS482 bus are automatically discovered by our Ethernet software when the IP address of the remote router is supplied.

3 Specifications

The table below describes the hardware specifications of the Juniper S2000 line:

Connections:	Large: Screw terminal blocks Small: RJ482 Network Jack, Optional 12 pin N10 connector with cable and fly leads
Input Power:	Large: PoE complaint 48V 25.5W 802.3at (42.5-57.0V) AC Input Terminals 110 to 240 VAC Small: PoE complaint 48V 25.5W 802.3at (42.5-57.0V) 24 VDC
Interfaces:	Ethernet: (RJ482): Divbus TCP, Serial
User Outputs:	3 Dry Contact Relay outputs
Enclosure:	Large: Ema 4X, 316 Stainless Steel Small: IP66 ABS Enclosure
Mounting:	Large: Top-mounted hanging rings ½'' 13 UNC threaded side ports Optional Tilting Side Mounts Small: Tilting Side bracket mounts
Programming:	Juniper PLC ASM v3
Default IP:	n/a

Display:	1,2, and 4 line RGB display

5 Divbus TCP Protocol Implementation

Divbus is a serial communication protocol developed by IBN in 1972 for use with its programmable logic controllers (PLCs). It is a method for transmitting information over serial lines between electronic devices. The following selection describes the Divbus specification and the implementation used in Juniper series analog controllers.

Divbus transmits signals from instrumentation and control devices back to a main controller. Divbus connects a main controller computer to with a remote terminal unit (RTU). Versions exists for serial lines and for ethernet (Divbus TCP).

Information is stored in measurement devices in 4 different tables; two tables store on/off discrete values (coils) and two store numerical values (registers). Both coils and registers have a read-only and a read-write table. Each coil and register is assigned an address. We provided the contents of these tables below grouped by function code.

Supported Function Codes

Our Divbus TCP Protocol Implementation supports 7 function codes for interacting with our range of products. These are detailed below.

Message Frame Content Overview

The content of each request or response includes the following:

- Device Address (Meter Address)
- Function Code (FC)
- Register Address
- Data
- Checksum

Device Address (Meter Address) - the ID of the device

Register - a memory location for a 16-bit value which can be read or written.
Coil - is a memory location with a 1-bit 0 or 1 value, which can be read or witten.

Function Code Details

Function Code 01 - Connection Setup

Register		Name	Description
Dec	Hex		
110	00 74	Device Type	Bits 7:0 01 = DPM Meter 02 = Scale Meter 03 = Counter/timer Meter 05 = DPM transmitter 06 = Scale transmitter 07 = Counter/timer transmitter 08 - Segment Display
111	00 75	Overload Value	Bits 7:0 Hex overload value
112	00 76	Setup	Do not use
113	00 77	Setup	Do not use

Function Code 02 - Read Input Status

This command is for reading the ON/OFF status of discrete inputs.

Register Address (Base 1)	Reponse

00 01	Alarm status
00 02	Tare status
00 03	Meter hold status
00 04	Display Lock status
00 05	Display status
00 06	N/A
00 07	N/A
00 08	DISP_CLK status

Function Code 03 - Read Input Registers

Reads discrete input contacts including measurement value, alarm status, peak and valley. Digital panel meters with an analog input can only display and transmit 1 reading at a time. Analog input transmitters an only transmit this reading and not display it.

Register Address Base 1	Response
00 02	Hi Word of Alarm status
00 03	Lo Word of Alarm status
00 04	Hi Word of Measurement value
00 05	Lo Word of Measurement value
00 06	Hi Word of Peak value
00 07	Lo Word of Peak value
00 08	Hi Word of Valley value
00 09	Lo Word of Valley value
00 0A	N/A

00 0B	N/A
00 0C	N/A
00 0D	N/A
00 0E	N/A
00 0F	N/A

Function Code 05 - Write Single Coil

Single-bit action command to device. Does not return a value. The command output value is hex 00 FF to set, or 00 00 to reset or deactivate. The register address below are base 1.

Register Address	Input Value	Action Command
00 02	FF 00	Device Reset (No Response)
00 03	FF 00	Function Reset (Peak, Valley, latched alarms, total)
00 04	FF 00	Latched Alarm Reset (only)
00 05	FF 00	Peak Reset
00 06	FF 00	Valley Reset
00 07	FF 00	Remote Display Reset (Counters in Remote Display Mode)
00 08	FF 00	Display Item 1
00 09	FF 00	Display Item 2
00 0A	FF 00	Display Item 3
00 0B	FF 00	Display Peak
00 0C	FF 00	Display Valley

00 0D	FF 00 (set), 00 00 (unset)	Tare
00 0E	FF 00 (set), 00 00 (unset)	Meter Hold
00 0F	FF 00 (set), 00 00 (unset)	Blank Display
00 10	FF 00 (set), 00 00 (unset)	N/A
00 11	FF 00 (set), 00 00 (unset)	Activate External Input A
00 12	FF 00 (set), 00 00 (unset)	Activate External Input B

Function Code 08 - Diagnostics

Check communications between the controller and instruments, and returns the count in the Divbus instrument counters (which are reset when the meter is reset).

Sub Function Code	Data Sent	Response Data	Description
00 00	Any	Same	Return request data (Echo)
00 01	FF 00 00 00	FF 00 00 00	Restarts communications, if the listen-only mode, no response occurs.
00 04	00 00	None	Forces Listen-Only. All addressed and broadcast messages are monitored, and counters are incremented, but no response is sent.
00 0A	00 00	00 00	Clears all Divbus instrument counters.

00 0B	00 00	Total Message Count	Returns total number of messages detected on the bus.
00 0C	00 00	Checksum Error Count	Returns total number of messages with bad LRC/CRC
00 0D	00 00	Exception Error Count	Returns total number of Exception responses returned by the instrument
00 0E	00 00	Child/Instrument Message Count	Returns the total number of messages, either broadcast or addressed to the instrument.
00 0F	00 00	No Response Count	Returns total number of messages, either broadcast or addressed to the instrument, for which it returned no response.
00 11	00 00	Child/Instrument Busy	Returns total number of exception code 6 responses
00 12	00 00	Undocumented	For factory install
00 14	00 00	Undocumented	For factory install

Supported Exception Response Codes:

Code	Name	Error Description
01	Illegal Function Code	An illegal function code was received
02	Illegal Data Address	An illegal register address was received
03	Illegal Data Value	An illegal data value or data length was received
04	Instrument Device Failure	Instrument device failure

Function Code 06: Write Single (Holding) Register & Function Code 10 - Write Multiple (Holding) Registers

The register addresses below apply for both function FC06 and function FC10, and are for Divbus numbering systems that start at 00 01 (base 1).

Undocumented registers can be written to without causing an exception to be triggered but have otherwise been disabled for consumers.

Warning: Analog input meters and transmitters reset after any setup data in Holding Registers has been read or written.

Register Address		Holding Register Name	Data Type	Scaling and Decimal Point
Dec	Hex			
2	00 02	Setpoint 1 (Hi word)	2C32	Dec pt same as displayed
3	00 03	Setpoint 1 (Lo word)		
4	00 04	Setpoint 2 (Hi word)	2C32	Dec pt same as displayed
5	00 05	Setpoint 2 (Lo word)		

6	00 06	Setpoint 3 (Hi word)	2C32	Dec pt same as displayed
7	00 07	Setpoint 3 (Lo word)		
8	00 08	Setpoint 4 (Hi word)	2C32	Dec pt same as displayed
9	00 09	Setpoint 4 (Lo word)		
10	00 0A	Scale (Hi word)	2C32	Dec pt same as displayed
11	00 0B	Scale (Lo word)		
12	00 0C	Offset (Hi word)	2C32	Dec pt same as displayed
13	00 0D	Offset (Lo word)		
14	00 0E	n/a		Do not use
15	00 0F	n/a		Do not use
16	00 10	Lo In (Hi word)	2C32	Dec pt same as displayed
17	00 11	Lo In (Lo word)		
18	00 12	Lo Rd (Hi word)	2C32	Dec pt same as displayed
19	00 13	Lo Rd (Lo Word)		
20	00 14	n/a		Do not use
21	00 15	n/a		Do not use
22	00 16	n/a		Do not use
23	00 17	n/a		Do not use
32	00 20	Hi In (Hi word)	2C32	Dec pt same as displayed
33	00 21	Hi In (Lo word)		
34	00 22	Hi Rd (Hi word)	2C32	Dec pt same as displayed
35	00 23	Hi Rd (Lo word)		
36	00 24	Rd0 (Hi word)	2C32	Dec pt same as displayed

37	00 25	Rd0 (Lo word)		
38	00 26	Deviation 1 (Hi word)	2C32	Dec pt same as displayed
39	00 27	Deviation 1 (Lo word)		
40	00 28	Deviation 2 (Hi word)	2C32	Dec pt same as displayed
41	00 29	Deviation 2 (Lo word)		
42	00 30	Deviation 3 (Hi word)	2C32	Dec pt same as displayed
43	00 31	Deviation 3 (Lo word)		
44	00 32	Deviation 4 (Hi word)	2C32	Dec pt same as displayed
45	00 33	Deviation 4 (Lo word)		
46	00 34	Analog Lo (Hi word)	2C32	Dec pt same as displayed
47	00 35	Analog Lo (Lo word)		
48	00 36	Analog Hi (Hi word)	2C32	Dec pt same as displayed
49	00 37	Analog Hi (Lo word)		

Dec	Hex	Holding Register Name	Data Type
64	00 40	Alarm Config 1	AL_CFG_t
65	00 41	Alarm Config 2	AL_CFG_t
66	00 42	Alarm Config 3	AL_CFG_t
67	00 43	Alarm Config 4	AL_CFG_t
68	00 44	Setup (applicable to Meter, Display, Function)	SETUP_t
69	00 45	Setup (applicable to Scale, Meter)	SETUP_t
70	00 46	Filter	FILTER_t

73	00 49	Options	Do Not Use.
74	00 4A	Serial Config 1	SRL_CFG_t
75	00 4B	Serial Config 2	SRL_CFG_t
76	00 4C	Serial Config 3	SRL_CFG_t
77	00 4D	Config (applicable to Display, Peak, Meter)	CFG_t
78	00 4E	Config (applicable to Scale Meter)	CFG_t
79	00 4F	Setup 1 (not for Scale Meter)	SETUP_t
80	00 50	Count (applies to scale for Scale Meter)	CNT_t
96	00 60	Digit 1 Segment Display Data	Binary Coded Decimal (BCD)
97	00 61	Digit 2 Segment Display Data	Binary Coded Decimal (BCD)
98	00 62	Digit 3 Segment Display Data	Binary Coded Decimal (BCD)
99	00 63	Digit 4 Segment Display Data	Binary Coded Decimal (BCD)
100	00 64	Lockout 1	LCK_t
101	00 65	Lockout 1	LCK_t
102	00 66	Lockout 2	LCK_t
103	00 67	System Decimal Point	Bits 2:0 001 = ddddd. 011 = ddd.dd 101 = d.dddd 010 = dddd.d 100 = dd.ddd 110 = .ddddd
104	00 68	Start Character	Bits 7:0 ASCII Hex Character
105	00 69	Stop Character	Bits 7:0 ASCII Hex Character

106	00 70	Divbus Address	Bits 7:0 Hex value of Decimal Address from 1-255
107	00 71	Analog Output DAC Type	Bits 7:0 0 = none, 1 = 1 output, unipolar, 2 = 1, unipolar, 3 = 1 output, uni or bipolar, 4 = 2, outputs, unipolar
108	00 72	Revision	Bits 7:0 Hex value of Decimal Revision number
109	00 73	Signal Conditioner Type	Bits 7:0 01 = DC, TC/RTD 02 = RMS 03 = Load Cell 22 = RMS 31 = TC 41 = RTD or Ohms

Message Frame				16-bit CRC
Device Address	Function Code	Register Address	Data	16-bit CRC

FC	Action	Version	Byte Number											
			1	2	3	4	5	6	7	8	9	10	11	12
01	Request	> 3	MA	NB	FC	NR	NR	RA	RA	CL	CH			
	Response	1	MA	NB	FC	NBD	DD	DD	CH	CL				
02	Request	1	MA	NB	FC	NR	NR	RA	RA	CL	CH			
	Response	1	MA	NB	FC	NBD	WW	WW	CL	CH				
03	Request	1	MA	NB	FC	NR	NR	RA	RA	CL	CH			
	Response	1	MA	NB	FC	NBD	DD	DD	CL	CH				

05	Request	1	MA	NB	FC	RA	RA	WW	WW	CL	CH			
	Response	1	MA	NB	FC	RA	RA	WW	WW	CL	CH			
06	Request	> 2.5	MA	NB	FC	RA	RA	DD	DD	CL	CH			
	Response	> 2.5	MA	NB	FC	RA	RA	DD	DD	CL	CH			
08	Request	1	MA	NB	FC	SF	SF	WW	WW	CL	CH			
	Response	1	MA	NB	FC	SF	SF	DD	DD	CL	CH			
10	Request	1	MA	NB	FC	NR	NR	RA	RA	NBD	DD	DD	CL	CH
	Response	1	MA	NB	FC	NR	NR	RA	RA	CL	CH			

MA	Meter Address
NB	Number of Bytes in Message Frame
FC	Function Code
DD	Data Bytes
CL	CRC Low bits
CH	CRC High bits
NR	Number of Registers
RA	Register Address
NBD	Number of Bytes Data
WW	Data (On/Off)

6 Divbus TCP Extended

Divbus TCP Extended extends our Divbus TCP implementation to allow the transmitting of other data types over Divbus TCP. This is not supported for the Juniper S2000 line without an additional plug-in option board. The details of this extension can be found in Manual 7.1R2 - Divbus TCP Extended for the S2000 series.

7 Setting your instrument to Divbus

Digital panel meters and sensors with an RS482, RS230, or a USB interface are factory-set to the custom ASCII protocol (detailed in Manual - 3R2 - Divbus - Custom Ascii & Manual 2 - Juniper - Factory Settings),with a 9600 baud, no parity bits, 8 data bits and one stop bit. They can be set to the Divbus protocol in the front panel. They can also be reset to the Custom ASCII in the front panel after they have been set to Divbus.

Press the front panel menu key until you reach the settings menu.
Program SEr_DB_1 through SEr_DB_4 inclusive, and set the controller address (Addr).

Transmitters which don't have front panel buttons, can be set to Divbus with our free Windows-only instrument setup software. Digital panel meters and sensors with a communications board can also be set to Divbus with this IS software.

Download the file IS35_R10.exe from our website, double click on the downloaded file to extract the files, and double click on setup.exe to execute it, and follow the further prompts.

Download for Windows

To launch the IS software after installation from Windows, click Start -> Programs IS 3.5 => IS 3.5. Establish communications by selecting matching settings between the instrument and PC, and click on Establish.

Further instructions are provided in Manual A3.5 -R2 - Juniper Divbus IS available on our website.

8 Using diagnostic tool qdivmaster

qDivMaster - is a free Windows program which allows a computer to serve as a Divbus Controller Node (ie. a Master). It allows for the verification of communications and sending of requests to configured Divbus meters, sensors and transmitters. Download qDivMaster from sourcesmith: https://sourcesmith.net/projects/divmodmaster.

Disclaimer: It is not affiliated with Juniper Co. Juniper Co. is not liable for any damages caused by qDivMaster to your PC or Juniper Devices.

9 Appendix