

Section 9 Appendices

9.1 T2-BUS Interface

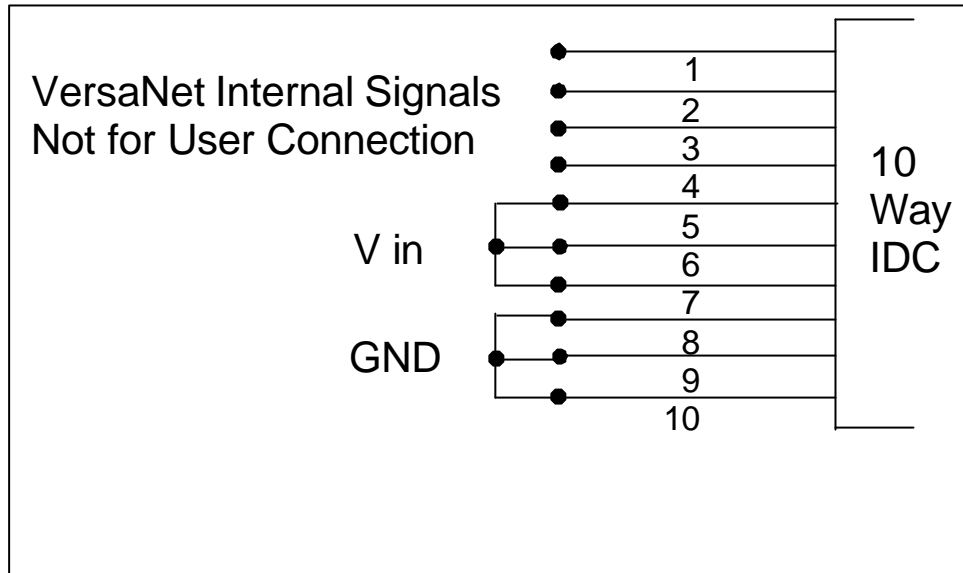


Figure 66 T2-BUS Interface Connections

T2-BUS is the proprietary communications protocol between all VersaNet2 modules in a Node. It is a secure, robust bit-bus structure that permits all processors to communicate directly.

In some circumstances, it may be necessary for system builders or end users to construct spare T2-BUS cables. This may be done easily using standard components. The cable is a 10 way keyed IDC parallel cable.

9.2 RS232 Data Highway Port

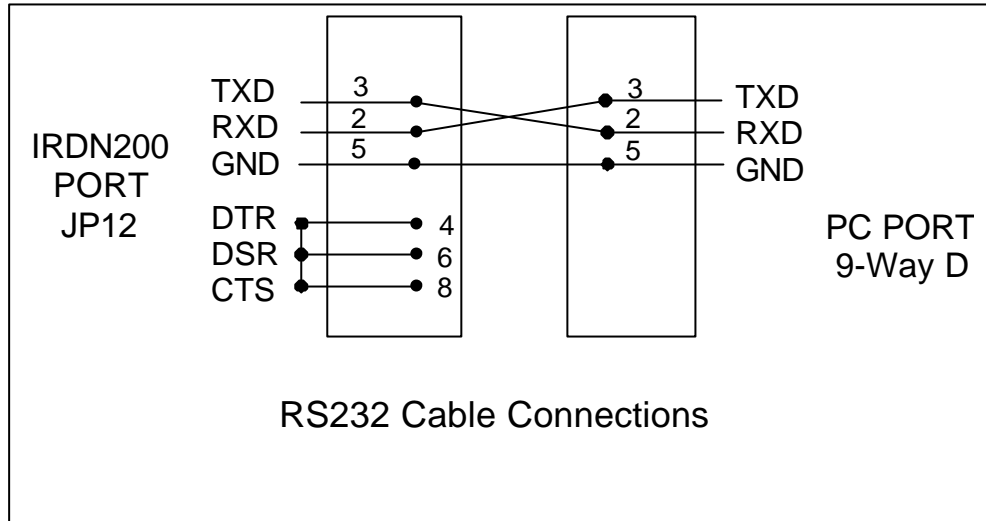


Figure 67 RS 232 Data Highway Port Connections

The RS232 Data Highway Port on the Communications Controller (JP12) is used to communicate with external process instruments and computers that utilize the MODBUS protocol.

9.3 RS232 Configuration Port

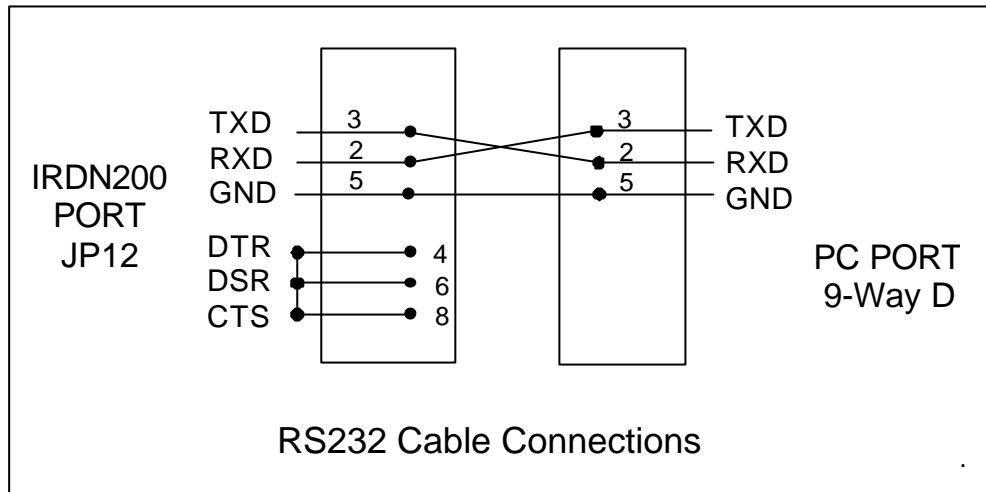


Figure 68 RS232 Configuration Port Connection

In order to configure a VersaNet 2 Node or to monitor local I/O, a PC running Windows 95 (or later) is plugged into the Configuration port on the Communications Controller (JP7). The serial port on the PC must be configured as follows: -

PC Serial Port Configuration

Baud Rate	9600
Parity	None
Number of Data Bits	8
Number of Stop Bits	1

9.4 Modbus Protocol

Controllers can be setup to communicate on standard Modbus networks using either of two transmission modes: ASCII or RTU. Users select the desired mode, along with the serial port communication parameters (baud rate, parity mode, etc.), during configuration of each controller. The mode and serial parameters must be the same for all devices on a Modbus network.

The selection of ASCII or RTU mode pertains only to standard Modbus networks. It defines the bit contents of message fields transmitted serially on those networks. It determines how information will be packed into the message fields and decoded.

On other networks like MAP and Modbus Plus, Modbus messages are placed into frames that are not related to serial transmission. For example, a request to read holding registers can be handled between two controllers on Modbus Plus without regard to the current setup of either controller's serial Modbus port.

ASCII Modbus

When controllers are setup to communicate on a Modbus network using ASCII (American Standard Code for Information Interchange) mode, each 8bit byte in a message is sent as two ASCII characters. The main advantage of this mode is that it allows time intervals of up to 1 second to occur between characters without causing an error.

The format of each byte in ASCII code is: -

Coding system: Hexadecimal, ASCII characters 0-9, A-F.
One hexadecimal character contained in each ASCII character of the message.

Bits per Byte: 1 start bit
7 data bits, least significant bit sent first
1 bit for even/odd parity; no bit for no parity
1 stop bit if parity is used; 2 stop bits for no parity

Error check field: Longitudinal Redundancy Check (LRC)

RTU Mode

When controllers are setup to communicate on a Modbus network using RTU (Remote Terminal Unit) mode, each 8bit byte in a message contains two 4bit hexadecimal characters. The main advantage of this mode is that its greater character density allows better data throughput than ASCII for the same baud rate. Each message must be transmitted in a single stream.

The format for each byte in RTU mode is: -

Coding system: 8-bit binary, hexadecimal 0-9, A-F
Two hexadecimal characters contained in each 8bit field of the message.

Bits per byte: 1 start bit
8 data bits, least significant bit sent first
1 bit for even/odd parity; no bit for no parity
1 stop bit if parity is used; 2 stop bits for no parity

Error check field: Cyclical Redundancy Check (CRC)

Modbus Message Framing

In either of the two serial transmission modes (ASCII or RTU), a Modbus message is placed by the transmitting device into a frame that has a known beginning and ending point. This allows receiving devices to begin at the start of a message, read the address portion and determine which device is addressed (or all devices, if the message is broadcast), and to know when the message is completed. Partial messages can be detected and errors can be set as a result.

On networks like MAP or Modbus Plus, the network protocol handles the framing of messages with beginning and end delimiters that are specific to the network. Those protocols also handle delivery to the destination device, making the Modbus address field imbedded in the message unnecessary for the actual transmission. (The Modbus address is converted to a Network Node address and routing path by the originating controller or its network adapter).

ASCII Framing

In ASCII mode, messages start with a 'colon' (␣ character (ASCII 3A hex), and end with a 'carriage return-line feed' (CRLF) pair (ASCII 0D and 0A hex).

The allowable characters transmitted for all other fields are hexadecimal 0-9, A-F. Networked devices monitor the network bus continuously for the 'colon' character. When one is received, each device decodes the next field (the address field) to find out if it is the addressed device.

Intervals of up to one second can elapse between characters within the message. If a greater interval occurs, the receiving device assumes an error has occurred. A typical message frame is shown below.

START	ADDRESS	FUNCTION	DATA	LRC CHECK	END
1 CHAR	2CHARS	2 CHARS	N CHARS	2 CHARS	2 CHARS CRLF

RTU Framing

In RTU mode, messages start with a silent interval of at least 3.5 character times. This is most easily implemented as a multiple of character times at the baud rate that is being used on the network (shown as T1-T2-T3-T4 in the figure below). The first field then transmitted is the device address.

The allowable characters transmitted for all fields are hexadecimal 0-9, A-F. Networked devices monitor the network bus continuously, including during the 'silent' intervals. When the first field (the address field) is received, each device decodes it to find out if it is the addressed device.

Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Similarly, if a new message begins earlier than 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will set an error, as the value in the final CRC field will not be valid for the combined message. A typical message frame is shown below:

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
T1-T2-T3-T4	8-BITS	8-BITS	n x 8-BITS	16 BITS	T1-T2-T3-T4

9.5 Modbus / VersaNet2 Address Mapping.

The following table shows the mapping of the Modbus Register number to the card I/O address on VersaNet2. This is an extract from the complete table. Obviously the table is continuous from register 0 to 2048 with the corresponding card addresses running from 1 to 256.

Register '0' corresponds to the I/O on the main communications controller card with addresses D0.1 and A0.1.

There are 2 combination cards which have fixed addresses;

- the combination Output card is card number 30, which has 4 Digital and 2 Analogue outputs, addresses D30.1, D30.2, D30.3, D30.4 and A30.1, A30.2
- the combination Input card is card number 31, which has 4 Digital and 4 Analogue Inputs, addresses D31.1, D31.2, D31.3, D31.4 and A31.1, A31.2, A31.3, A31.4

The card numbers 1 to 29 can be assigned to any I/O cards in a Node. Numbers 32 to 256 can be used as Virtual outputs.

Table of Modbus / VersaNet Address Mapping

Register	Digital Inputs	Analog Inputs	Digital Outputs	Analog Outputs
0	D0.1	A0.1	D0.1	A0.1
1	D1.1	A1.1	D1.1	A1.1
2	D1.2	A1.2	D1.2	A1.2
3	D1.3	A1.3	D1.3	A1.3
4	D1.4	A1.4	D1.4	A1.4
5	D1.5	A1.5	D1.5	A1.5
6	D1.6	A1.6	D1.6	A1.6
7	D1.7	A1.7	D1.7	A1.7
8	D1.8	A1.8	D1.8	A1.8
9	D2.1	A2.1	D2.1	A2.1
10	D2.2	A2.2	D2.2	A2.2
11	D2.3	A2.3	D2.3	A2.3
12	D2.4	A2.4	D2.4	A2.4
13	D2.5	A2.5	D2.5	A2.5
14	D2.6	A2.6	D2.6	A2.6
15	D2.7	A2.7	D2.7	A2.7
16	D2.8	A2.8	D2.8	A2.8
17	D3.1	A3.1	D3.1	A3.1
18	D3.2	A3.2	D3.2	A3.2
19	D3.3	A3.3	D3.3	A3.3
20	D3.4	A3.4	D3.4	A3.4
21	D3.5	A3.5	D3.5	A3.5
22	D3.6	A3.6	D3.6	A3.6
23	D3.7	A3.7	D3.7	A3.7
24	D3.8	A3.8	D3.8	A3.8
25	D4.1	A4.1	D4.1	A4.1
26	D4.2	A4.2	D4.2	A4.2
27	D4.3	A4.3	D4.3	A4.3
28	D4.4	A4.4	D4.4	A4.4
29	D4.5	A4.5	D4.5	A4.5
30	D4.6	A4.6	D4.6	A4.6
31	D4.7	A4.7	D4.7	A4.7
32	D4.8	A4.8	D4.8	A4.8
33	D5.1	A5.1	D5.1	A5.1
34	D5.2	A5.2	D5.2	A5.2
35	D5.3	A5.3	D5.3	A5.3
36	D5.4	A5.4	D5.4	A5.4
37	D5.5	A5.5	D5.5	A5.5
38	D5.6	A5.6	D5.6	A5.6
39	D5.7	A5.7	D5.7	A5.7
40	D5.8	A5.8	D5.8	A5.8
41	D6.1	A6.1	D6.1	A6.1
42	D6.2	A6.2	D6.2	A6.2
43	D6.3	A6.3	D6.3	A6.3
44	D6.4	A6.4	D6.4	A6.4
45	D6.5	A6.5	D6.5	A6.5
46	D6.6	A6.6	D6.6	A6.6
47	D6.7	A6.7	D6.7	A6.7
48	D6.8	A6.8	D6.8	A6.8
49	D7.1	A7.1	D7.1	A7.1
50	D7.2	A7.2	D7.2	A7.2
51	D7.3	A7.3	D7.3	A7.3
52	D7.4	A7.4	D7.4	A7.4
53	D7.5	A7.5	D7.5	A7.5
54	D7.6	A7.6	D7.6	A7.6
55	D7.7	A7.7	D7.7	A7.7

56	D7.8	A7.8	D7.8	A7.8
57	D8.1	A8.1	D8.1	A8.1
58	D8.2	A8.2	D8.2	A8.2
59	D8.3	A8.3	D8.3	A8.3
60	D8.4	A8.4	D8.4	A8.4
61	D8.5	A8.5	D8.5	A8.5
62	D8.6	A8.6	D8.6	A8.6
63	D8.7	A8.7	D8.7	A8.7
64	D8.8	A8.8	D8.8	A8.8
65	D9.1	A9.1	D9.1	A9.1
66	D9.2	A9.2	D9.2	A9.2
67	D9.3	A9.3	D9.3	A9.3
68	D9.4	A9.4	D9.4	A9.4
69	D9.5	A9.5	D9.5	A9.5
70	D9.6	A9.6	D9.6	A9.6
71	D9.7	A9.7	D9.7	A9.7
72	D9.8	A9.8	D9.8	A9.8
73	D10.1	A10.1	D10.1	A10.1
74	D10.2	A10.2	D10.2	A10.2
75	D10.3	A10.3	D10.3	A10.3
76	D10.4	A10.4	D10.4	A10.4
77	D10.5	A10.5	D10.5	A10.5
78	D10.6	A10.6	D10.6	A10.6
79	D10.7	A10.7	D10.7	A10.7
80	D10.8	A10.8	D10.8	A10.8
81	D11.1	A11.1	D11.1	A11.1
82	D11.2	A11.2	D11.2	A11.2
83	D11.3	A11.3	D11.3	A11.3
84	D11.4	A11.4	D11.4	A11.4
85	D11.5	A11.5	D11.5	A11.5
86	D11.6	A11.6	D11.6	A11.6
87	D11.7	A11.7	D11.7	A11.7
88	D11.8	A11.8	D11.8	A11.8
89	D12.1	A12.1	D12.1	A12.1
90	D12.2	A12.2	D12.2	A12.2
91	D12.3	A12.3	D12.3	A12.3
92	D12.4	A12.4	D12.4	A12.4
93	D12.5	A12.5	D12.5	A12.5
94	D12.6	A12.6	D12.6	A12.6
95	D12.7	A12.7	D12.7	A12.7
96	D12.8	A12.8	D12.8	A12.8
97	D13.1	A13.1	D13.1	A13.1
98	D13.2	A13.2	D13.2	A13.2
99	D13.3	A13.3	D13.3	A13.3
100	D13.4	A13.4	D13.4	A13.4
101	D13.5	A13.5	D13.5	A13.5
102	D13.6	A13.6	D13.6	A13.6
103	D13.7	A13.7	D13.7	A13.7

104	D13.8	A13.8	D13.8	A13.8
105	D14.1	A14.1	D14.1	A14.1
106	D14.2	A14.2	D14.2	A14.2
107	D14.3	A14.3	D14.3	A14.3
108	D14.4	A14.4	D14.4	A14.4
109	D14.5	A14.5	D14.5	A14.5
110	D14.6	A14.6	D14.6	A14.6
111	D14.7	A14.7	D14.7	A14.7
112	D14.8	A14.8	D14.8	A14.8
113	D15.1	A15.1	D15.1	A15.1
114	D15.2	A15.2	D15.2	A15.2
115	D15.3	A15.3	D15.3	A15.3
116	D15.4	A15.4	D15.4	A15.4
117	D15.5	A15.5	D15.5	A15.5
118	D15.6	A15.6	D15.6	A15.6
119	D15.7	A15.7	D15.7	A15.7
120	D15.8	A15.8	D15.8	A15.8
121	D16.1	A16.1	D16.1	A16.1
122	D16.2	A16.2	D16.2	A16.2
123	D16.3	A16.3	D16.3	A16.3
124	D16.4	A16.4	D16.4	A16.4
125	D16.5	A16.5	D16.5	A16.5
126	D16.6	A16.6	D16.6	A16.6
127	D16.7	A16.7	D16.7	A16.7
128	D16.8	A16.8	D16.8	A16.8
129	D17.1	A17.1	D17.1	A17.1
130	D17.2	A17.2	D17.2	A17.2
131	D17.3	A17.3	D17.3	A17.3
132	D17.4	A17.4	D17.4	A17.4
133	D17.5	A17.5	D17.5	A17.5
134	D17.6	A17.6	D17.6	A17.6
135	D17.7	A17.7	D17.7	A17.7
136	D17.8	A17.8	D17.8	A17.8
137	D18.1	A18.1	D18.1	A18.1
138	D18.2	A18.2	D18.2	A18.2
139	D18.3	A18.3	D18.3	A18.3
140	D18.4	A18.4	D18.4	A18.4
141	D18.5	A18.5	D18.5	A18.5
142	D18.6	A18.6	D18.6	A18.6
143	D18.7	A18.7	D18.7	A18.7
144	D18.8	A18.8	D18.8	A18.8
145	D19.1	A19.1	D19.1	A19.1
146	D19.2	A19.2	D19.2	A19.2
147	D19.3	A19.3	D19.3	A19.3
148	D19.4	A19.4	D19.4	A19.4
149	D19.5	A19.5	D19.5	A19.5
150	D19.6	A19.6	D19.6	A19.6
151	D19.7	A19.7	D19.7	A19.7

152	D19.8	A19.8	D19.8	A19.8
153	D20.1	A20.1	D20.1	A20.1
154	D20.2	A20.2	D20.2	A20.2
155	D20.3	A20.3	D20.3	A20.3
156	D20.4	A20.4	D20.4	A20.4
157	D20.5	A20.5	D20.5	A20.5
158	D20.6	A20.6	D20.6	A20.6
159	D20.7	A20.7	D20.7	A20.7
160	D20.8	A20.8	D20.8	A20.8
161	D21.1	A21.1	D21.1	A21.1
162	D21.2	A21.2	D21.2	A21.2
163	D21.3	A21.3	D21.3	A21.3
164	D21.4	A21.4	D21.4	A21.4
165	D21.5	A21.5	D21.5	A21.5
166	D21.6	A21.6	D21.6	A21.6
167	D21.7	A21.7	D21.7	A21.7
168	D21.8	A21.8	D21.8	A21.8
169	D22.1	A22.1	D22.1	A22.1
170	D22.2	A22.2	D22.2	A22.2
171	D22.3	A22.3	D22.3	A22.3
172	D22.4	A22.4	D22.4	A22.4
173	D22.5	A22.5	D22.5	A22.5
174	D22.6	A22.6	D22.6	A22.6
175	D22.7	A22.7	D22.7	A22.7
176	D22.8	A22.8	D22.8	A22.8
177	D23.1	A23.1	D23.1	A23.1
178	D23.2	A23.2	D23.2	A23.2
179	D23.3	A23.3	D23.3	A23.3
180	D23.4	A23.4	D23.4	A23.4
181	D23.5	A23.5	D23.5	A23.5
182	D23.6	A23.6	D23.6	A23.6
183	D23.7	A23.7	D23.7	A23.7
184	D23.8	A23.8	D23.8	A23.8
185	D24.1	A24.1	D24.1	A24.1
186	D24.2	A24.2	D24.2	A24.2
187	D24.3	A24.3	D24.3	A24.3
188	D24.4	A24.4	D24.4	A24.4
189	D24.5	A24.5	D24.5	A24.5
190	D24.6	A24.6	D24.6	A24.6
191	D24.7	A24.7	D24.7	A24.7
192	D24.8	A24.8	D24.8	A24.8
193	D25.1	A25.1	D25.1	A25.1
194	D25.2	A25.2	D25.2	A25.2
195	D25.3	A25.3	D25.3	A25.3
196	D25.4	A25.4	D25.4	A25.4
197	D25.5	A25.5	D25.5	A25.5
198	D25.6	A25.6	D25.6	A25.6
199	D25.7	A25.7	D25.7	A25.7

200	D25.8	A25.8	D25.8	A25.8
201	D26.1	A26.1	D26.1	A26.1
202	D26.2	A26.2	D26.2	A26.2
203	D26.3	A26.3	D26.3	A26.3
204	D26.4	A26.4	D26.4	A26.4
205	D26.5	A26.5	D26.5	A26.5
206	D26.6	A26.6	D26.6	A26.6
207	D26.7	A26.7	D26.7	A26.7
208	D26.8	A26.8	D26.8	A26.8
209	D27.1	A27.1	D27.1	A27.1
210	D27.2	A27.2	D27.2	A27.2
211	D27.3	A27.3	D27.3	A27.3
212	D27.4	A27.4	D27.4	A27.4
213	D27.5	A27.5	D27.5	A27.5
214	D27.6	A27.6	D27.6	A27.6
215	D27.7	A27.7	D27.7	A27.7
216	D27.8	A27.8	D27.8	A27.8
217	D28.1	A28.1	D28.1	A28.1
218	D28.2	A28.2	D28.2	A28.2
219	D28.3	A28.3	D28.3	A28.3
220	D28.4	A28.4	D28.4	A28.4
221	D28.5	A28.5	D28.5	A28.5
222	D28.6	A28.6	D28.6	A28.6
223	D28.7	A28.7	D28.7	A28.7
224	D28.8	A28.8	D28.8	A28.8
225	D29.1	A29.1	D29.1	A29.1
226	D29.2	A29.2	D29.2	A29.2
227	D29.3	A29.3	D29.3	A29.3
228	D29.4	A29.4	D29.4	A29.4
229	D29.5	A29.5	D29.5	A29.5
230	D29.6	A29.6	D29.6	A29.6
231	D29.7	A29.7	D29.7	A29.7
232	D29.8	A29.8	D29.8	A29.8
233			D30.1	A30.1
234			D30.2	A30.2
235			D30.3	
236			D30.4	
237				
238				
239				
240				
241	D31.1	A31.1		
242	D31.2	A31.2		
243	D31.3	A31.3		
244	D31.4	A31.4		
245				
246				
247				

248				
249	D32.1	A32.1	D32.1	A32.1
250	D32.2	A32.2	D32.2	A32.2
251	D32.3	A32.3	D32.3	A32.3
252	D32.4	A32.4	D32.4	A32.4
253	D32.5	A32.5	D32.5	A32.5
254	D32.6	A32.6	D32.6	A32.6
255	D32.7	A32.7	D32.7	A32.7
256	D32.8	A32.8	D32.8	A32.8
257	D33.1	A33.1	D33.1	A33.1
258	D33.2	A33.2	D33.2	A33.2
259	D33.3	A33.3	D33.3	A33.3
260	D33.4	A33.4	D33.4	A33.4
261	D33.5	A33.5	D33.5	A33.5
262	D33.6	A33.6	D33.6	A33.6
263	D33.7	A33.7	D33.7	A33.7
264	D33.8	A33.8	D33.8	A33.8
265	D34.1	A34.1	D34.1	A34.1
266	D34.2	A34.2	D34.2	A34.2
267	D34.3	A34.3	D34.3	A34.3
268	D34.4	A34.4	D34.4	A34.4
269	D34.5	A34.5	D34.5	A34.5
270	D34.6	A34.6	D34.6	A34.6
271	D34.7	A34.7	D34.7	A34.7
272	D34.8	A34.8	D34.7	A34.8
<div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>				
2017	D253.1	A253.1	D253.1	A253.1
2018	D253.2	A253.2	D253.2	A253.2

2019	D253.3	A253.3	D253.3	A253.3
2020	D253.4	A253.4	D253.4	A253.4
2021	D253.5	A253.5	D253.5	A253.5
2022	D253.6	A253.6	D253.6	A253.6
2023	D253.7	A253.7	D253.7	A253.7
2024	D253.8	A253.8	D253.8	A253.8
2025	D254.1	A254.1	D254.1	A254.1
2026	D254.2	A254.2	D254.2	A254.2
2027	D254.3	A254.3	D254.3	A254.3
2028	D254.4	A254.4	D254.4	A254.4
2029	D254.5	A254.5	D254.5	A254.5
2030	D254.6	A254.6	D254.6	A254.6
2031	D254.7	A254.7	D254.7	A254.7
2032	D254.8	A254.8	D254.8	A254.8
2033	D255.1	A255.1	D255.1	A255.1
2034	D255.2	A255.2	D255.2	A255.2
2035	D255.3	A255.3	D255.3	A255.3
2036	D255.4	A255.4	D255.4	A255.4
2037	D255.5	A255.5	D255.5	A255.5
2038	D255.6	A255.6	D255.6	A255.6
2039	D255.7	A255.7	D255.7	A255.7
2040	D255.8	A255.8	D255.8	A255.8
2041	D256.1	A256.1	D256.1	A256.1
2042	D256.2	A256.2	D256.2	A256.2
2043	D256.3	A256.3	D256.3	A256.3
2044	D256.4	A256.4	D256.4	A256.4
2045	D256.5	A256.5	D256.5	A256.5
2046	D256.6	A256.6	D256.6	A256.6
2047	D256.7	A256.7	D256.7	A256.7
2048	D256.8	A256.8	D256.8	A256.8