CHAPTER 3

M9000 Series Retrofits

3.1 Status – Schneider Electric Replacement Board

Schneider Electric offers a Status Input board that replace legacy M9000 Status Input cards for retrofit purposes. These cards have the same form factor and field wiring inputs as the legacy cards to minimize retrofit time. All Schneider Electric Status input boards offer 1500V opto-coupler protection, dry contact operation, and isolated status loop voltage capabilities of 24V, 48V or 125VDC inputs. An earth-grounding stud is provided on each board to facilitate proper grounding and shield connection, if required. Connection to the SAGE 2000 baseboard and subsequent Status Input boards are made using standard 20-pin ribbon cables. All boards utilize Surface Mount Technology (SMT) for space savings and ease of manufacturing. Circuit board theory and operation for each card is described in the next section.

C3455 8-Point Status Input Board

The Schneider Electric C3455 (Figure 3-1) board replaces each legacy M9000 8-point board.. The Board features 8-32 style barrier termination as on the Legacy unit so field wiring can easily be transferred to the new board with minimal effort.

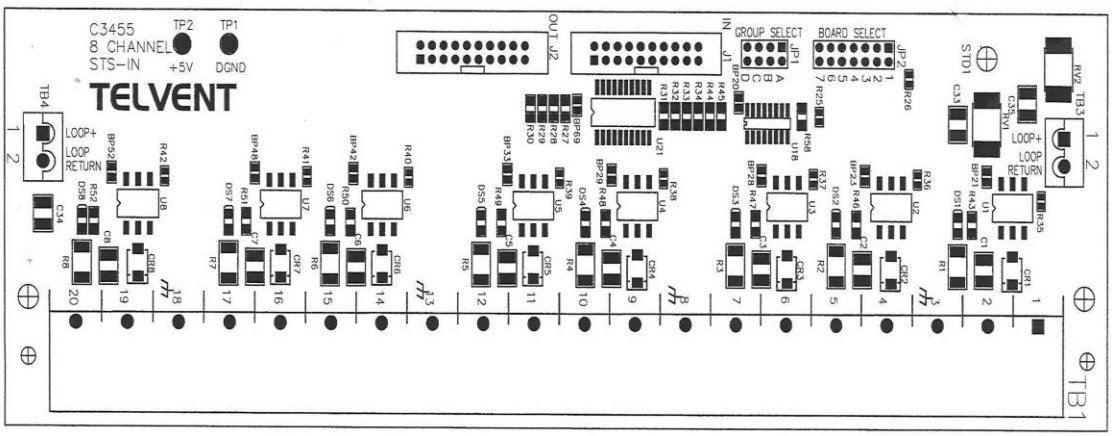


Figure 3-1 Schneider Electric C3455 8-Point Status with 8-32 barrier termination

3.1.1 Status Theory

The C3455 Status Board mounts into the existing 3 inch wide snap track of the RTU being retrofitted. Inter-connecting ribbon cabling between cards is accomplished by placing the 20 pin ribbon cable from the Sage 2000 baseboard to the first status board in the chain into the IN Connector J1. Add additional cards by placing a 20 pin ribbon from the preceding cards' OUT (J2) connector to the next cards IN Connector. Repeat for all boards in the status chain. Wetting voltage is also wired from the source to TB3 of the first Status Board in the chain, and then can be carried to the next card from TB4. These two connections are common, and can be used interchangeably for power.

Each board has a BOARD SELECT and a GROUP SELECT Set of jumpers to enable each board to a specific point address. Since each BOARD SELECT can handle 32 status inputs, jumpers must be set to accommodate which Group of 8 points are present on that board. The jumpers follow the table below:

Table 3-1 C3455 Jumper Table

XT-DI Points	BOARD SELECT JP2	GROUP SELECT JP1	XT-DI Points	BOARD SELECT JP2	GROUP SELECT JP1
1 – 8	1	A	113 – 120	4	C
9 – 16	1	B	121 – 128	4	D
17 – 24	1	C	129 – 136	5	A
25 – 32	1	D	137 – 144	5	B
33 – 40	2	A	145 – 152	5	C
41 – 48	2	B	153 – 160	5	D
49 – 56	2	C	161 – 168	6	A
57 – 64	2	D	169 – 176	6	B
65 – 72	3	A	177 – 184	6	C
73 – 80	3	B	185 – 192	6	D
81 – 88	3	C	193 – 200	7	A
89 – 96	3	D	201 – 208	7	B
97 – 104	4	A	209 – 216	7	C
105 – 112	4	B	217 – 224	7	D

Each DI input is optically isolated (1500V isolation) and provided with an input RC filter. Additional debounce filtering is done in firmware. The firmware waits 20 milliseconds after an initial change of state (COS) to see if the COS is still there. If it is, the input is considered valid and processed.

The variations for the C3455 boards are loop resistors that determine the loop wetting voltage. The variations are as follows:

VARIANCE STRUCTURE :

−00003 = 2.2K RESISTORS, 24VDC.

−00004 = 20.0K RESISTORS, 129VDC.

−00005 = 6.2K RESISTORS, 48VDC.

For complete theory details, please see the Status Input XT section in the Theory of Operation chapter of the SAGE 2X00 Operation & Maintenance manual.

3.2 Analog – Schneider Electric Replacement Board

The Schneider Electric C3443 is an 8 point DC Analog Input board (Figure 3-2) that replaces each of the legacy M9000 8 Point Analog Boards. The Board features 8-32 style barrier termination as on the Legacy unit so field wiring can easily be transferred to the new board with minimal effort.

The Schneider Electric Analog Input board can be ordered to accept one of the following input types: +/-5V, +/-1Ma, 4-20Ma. All analog inputs utilize precision resistors for analog accuracy.

An earth-grounding stud is provided on each board to facilitate proper grounding and a shield connection is provided for each analog Point. Connection to the SAGE 2000 baseboard, and subsequent Analog input boards, are made using standard 20-pin ribbon cables. The Analog input board utilizes Surface Mount Technology (SMT) for space savings and ease of manufacturing. Circuit board theory and operation is described in the following section.

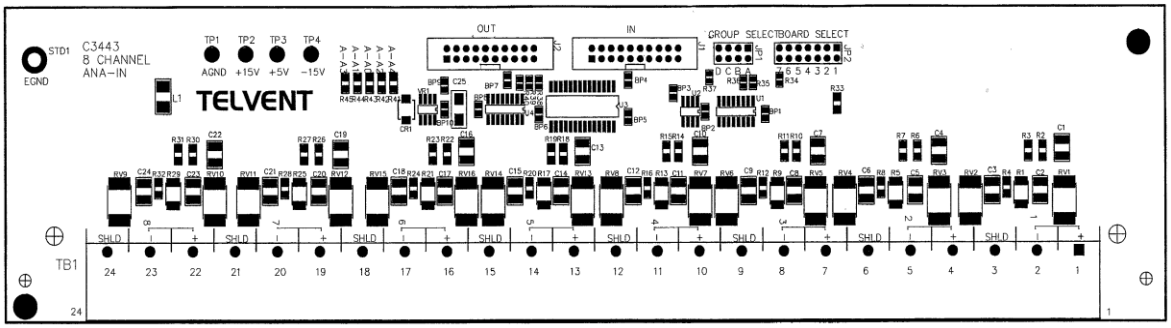


Figure 3-2 Schneider Electric 8-Point Analog with Barrier Terminal Block

3.2.1 Analog Theory

The C3453 Analog Input Board mounts into the existing 3 inch wide snap track of the RTU being retrofitted. Inter-connecting ribbon cabling between cards is accomplished by placing the 20 pin ribbon cable from the Sage 2000 baseboard to the first Analog Input board in the chain into the IN connector (J1). Add additional cards by placing a 20 pin ribbon from the preceding cards' OUT connector (J2) to the next cards IN Connector. Repeat for all boards in the status chain.

Each board has a BOARD SELECT and a GROUP SELECT Set of jumpers to enable each board to a specific point address. Since each BOARD SELECT can handle 32 Analog Inputs, jumpers must be set to accommodate which Group of 8 points are present on that board. The jumpers follow the table below:

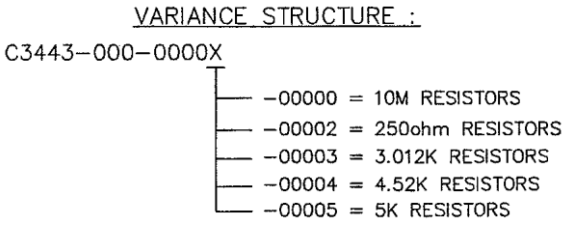
For complete theory details, please see the Analog Input XT section in the Theory of Operation chapter of the SAGE 2400 Operation & Maintenance manual.

Table 3-2 C3443 Jumper Table

XT-AI Points	BOARD SELECT JP2	GROUP SELECT JP1	XT-AI Points	BOARD SELECT JP2	GROUP SELECT JP1

1 – 8	1	A	113 – 120	4	C
9 – 16	1	B	121 – 128	4	D
17 – 24	1	C	129 – 136	5	A
25 – 32	1	D	137 – 144	5	B
33 – 40	2	A	145 – 152	5	C
41 – 48	2	B	153 – 160	5	D
49 – 56	2	C	161 – 168	6	A
57 – 64	2	D	169 – 176	6	B
65 – 72	3	A	177 – 184	6	C
73 – 80	3	B	185 – 192	6	D
81 – 88	3	C	193 – 200	7	A
89 – 96	3	D	201 – 208	7	B
97 – 104	4	A	209 – 216	7	C
105 – 112	4	B	217 – 224	7	D

The C3442 has a number of variations that Include DC voltage and DC Current input options, the most popular being +/-1mA (5K Loop Resisters, and 4-20mA inputs (250 Ohm Resistors). The full variance is detailed below:



Conversion from analog to digital signal is done on the baseboard. Each input is multiplexed into the A/D converter and processed every second.

3.3 SBO Control – Schneider Electric Replacement Board

The C3450 4 Point Rack Driver Board (Figure 3-3) is designed to control up to 8 relay coils of discretely mounted relays. Connections to the relay coils are made through discrete wire connections from TB1 and TB2. Since the Sage RTU Control Bus can operate up to 16 coils from each execute line, the C3450 has a set of jumpers K1 – K8 which route the appropriate CSEL lines to the circuit. Likewise, the Execute bus has jumpers EXE0 – EXE7 to control up to a total of 128 relay coils or 64 T/C Control Points. The C3450 receives the SBO bus from the Sage 2000 baseboard at the IN connector (J1). Remaining controls are connected from the OUT connector (J2) to the IN connector of additional cards in a daisy chain fashion. The C3450 can be configured to control from 1 to 8 relay coils per card.

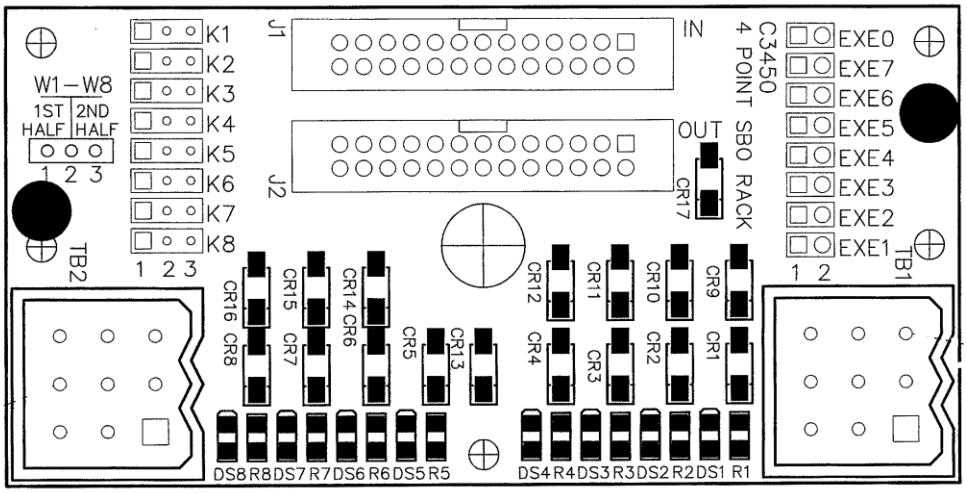


Figure 3-3 Schneider Electric C3450 4 Point Rack Driver Board

3.3.1 SBO Control Theory

Table 3-3 illustrates the jumper configuration of the C3450 board. When K1 – K8 are configured in the 1st Half position, relay coils 1 – 8 will operate, when the board is configured for the 2nd Half, relay coils 9 – 16 will be operating per Execute Line.

For complete theory details, please see the Select Before Operate XT section in the Theory of Operation chapter of the SAGE 2X00 Operation & Maintenance manual.

EXE0–EXE7 JUMPER	K1–K8 JUMPER POSITION	CARD HALF	RELAY NUMBER	SBO POINT
*EXE1	*1–2	1st HALF	1–8	1–4
	2–3	2nd HALF	9–16	5–8
EXE2	1–2	1st HALF	17–24	9–12
	2–3	2nd HALF	25–32	13–16
EXE3	1–2	1st HALF	33–40	17–20
	2–3	2nd HALF	41–48	21–24
EXE4	1–2	1st HALF	49–56	25–28
	2–3	2nd HALF	57–64	29–32
EXE5	1–2	1st HALF	65–72	33–36
	2–3	2nd HALF	73–80	37–40
EXE6	1–2	1st HALF	81–88	41–44
	2–3	2nd HALF	89–96	45–48
EXE7	1–2	1st HALF	97–104	49–52
	2–3	2nd HALF	105–112	53–56
EXE0	1–2	1st HALF	113–120	57–60
	2–3	2nd HALF	121–128	61–64

Table 3-3 C3450 Jumper Table