

40235 Dual Voltage Controlled Filter

Introduction

The 40235 Dual Filter Module is an upgrade unit for ARP synthesizers. The 40235 adds sound shaping capabilities to your synthesizer by offering the sonic versatility of two different filter types.

Description

The 40235 Dual Filter Module integrates the circuitry of two of the most popular voltage controlled lowpass filters, the ARP 4023 and 4035, onto a single board. The 4023 is the filter found in early Odyssey synthesizers (model 2800), a 2-pole (12 dB/oct) OTA-based biquad design. The 4035 is a 4-pole (24 dB/oct) design built around Moog's transistor ladder, and was originally installed into Odyssey models 2810-2812. This rather rare filter is similar to the 4012 filter which was used in early model 2600 synthesizers, although it uses IC transistor arrays instead of matched discrete transistor pairs.

The upgrade adds a front panel control for switching between 2-pole and 4-pole filter modes.

The 40235 is signal compatible with ARP 4035 and 4075 filters, and can be used as a direct replacement in the following instruments:

AXXE-2	(models 2310 and higher)
ODYSSEY-2	(models 2810 and higher)
AVATAR	(all models)
OMNI	(all models)
OMNI-2	(all models)
QUADRA	(all models)

Construction

The PCB (printed circuit board) is of the double-sided type, i.e. there are copper tracks on both sides. This implies that unless the board has through-plated holes, any component leads that are connected to tracks on the component side must be soldered on both sides.

Before soldering in any components, solder in wire links at through-holes which are not associated with component leads. The sequence for fitting the components is not critical, however, the following order is recommended: (1) ICs, (2) resistors, (3) transistors, (4) capacitors, (5) trimpots, and finally, (6) connectors. Thoroughly clean any flux residue off the board using acetone, or other suitable solvent.

Installation

The 40235 module should be mounted close to where the original filter was located, for example, just underneath the filter control potentiometers. Mark drill holes on the synth main board using the 40235 as a template. Drill 3.5 mm holes, and mount the unit using suitable PCB stand-offs.

Connections between the 40235 and the main board are made using a short length (<15 cm) of 10-way flat cable, and a 10-way IDC connector. Solder the loose ends of the flat cable to the main board as per the 40235 assembly drawing. Note that pins 3, 14, and 18 of the main board connection pads are not used.

The filter selection switch is of the DPDT type, and should be wired to a 3-way Molex-type connector, as shown in the assembly drawing. In addition, the filter selection switch is used to switch in a 15kohm (0.25W, metal film) resistor between the upper end-point and wiper of the Resonance slider when 2-pole mode is selected. This is to add resolution to the Resonance control taper when operating the 2-pole filter.

Choose a location for the DPDT switch on the front panel such that it does not interfere with the main board components. Remove any PCBs attached to the front panel before drilling.

Calibration

NOTE: Allow the unit to warm up for at least ten minutes before carrying out calibration.

4-pole CV Rejection

1. Switch to 4-pole mode, and monitor the filter output with an oscilloscope.
2. Put the ADSR DECAY slider at 1/4, and the other ADSR controls fully down.
3. Route the ADSR output to the filter control input, and raise the associated amount slider fully up.
4. If possible, use the LFO to retrigger the ADSR (AUTO REPEAT). Adjust the CVR trimmer on the 40235 board for minimum amplitude signal on the filter output while the ADSR is constantly being retriggered.

4-pole Tuning Offset

NOTE: The following adjustment affects both the 4-pole and the 2-pole filter on the 40235 board.

1. Switch the 40235 to 4-pole mode and monitor the output with an oscilloscope.
2. Make the filter self-oscillate by raising the RESONANCE slider to maximum. On the OMNI, OMNI-2, and QUADRA, you need to clip an extra 33kohm resistor between pins 10 and 2 of the main board filter connection points.
3. Adjust the FREQ CAL/VCF CUTOFF/VCF CAL trimmer on the main board for a 62.5 ms period, or, 16 Hz.

4-pole Tune Scaling (not applicable for OMNI, OMNI-2)

NOTE: The following adjustment affects both the 4-pole and the 2-pole filter on the 40235 board.

1. Make the filter self-oscillate (see above).
2. Put the VCF KYBD CV slider at maximum (not applicable for QUADRA), and all other VCF sliders down.
3. Pin low 'C' on the keyboard.
4. Monitor the filter output with a frequency counter.
5. Adjust the VCF FREQUENCY slider for 100 Hz.
6. Pin high 'C' (three octaves higher) on the keyboard.
7. Adjust the VCF V/OCT trimmer on the main board for 800 Hz.
8. Repeat steps 3 through 7 until the frequency is correct at low 'C' and high 'C'.

2-pole gm Balance

1. Switch to 2-pole mode, and make the filter self-oscillate (see above).
2. Monitor the filter output, and pin 1 of U3 on the 40235 board simultaneously.
3. Adjust the VCF FREQUENCY slider for a sine wave of about 1 kHz.
4. Adjust the BAL trimmer on the 40235 board so that the two signals have equal amplitude.

2-pole Tune Scaling

NOTE: Always perform 4-pole calibration before carrying out the following steps.

1. Switch to 4-pole mode, and make the filter self-oscillate (see above).
2. Put the VCF KYBD CV slider at maximum (not applicable for QUADRA), and all other VCF sliders down.
3. Pin low 'C' on the keyboard.
4. Monitor the filter output with a frequency counter.
5. Adjust the VCF FREQUENCY slider for 100 Hz.
6. Switch to 2-pole mode, and adjust the TOFS trimmer on the 40235 board for approximately the same frequency as in 4-pole mode.
7. Alternate between low 'C' and high 'C' (three octaves higher), while adjusting the TSCL trimmer on the 40235 board until low 'C' and high 'C' are exactly three octaves apart.

2-pole Tuning Offset

NOTE: Always perform 4-pole calibration before carrying out the following steps.

1. Switch to 2-pole mode, and make the filter self-oscillate (see above).
2. Adjust the VCF FREQUENCY slider for approximately 1 kHz.
3. Adjust the TOFS trimmer on the 40235 board so that the 2-pole frequency equals the 4-pole frequency.

In Use

The 40235 dual filter is capable of a wide variety of low-pass responses and characteristic tonal colouration. In 4-pole mode, you have the "fat" sound of a 24 dB/oct filter slope, while the 2-pole mode gives a less dramatic, more electronic sound. Also, while the signal output levels in the two filter modes are equal at low resonance settings, there will be a noticeable difference in output level at high resonance, since the 4-pole mode features the typical drop in passband gain. This is also evident when driving the filters into self-oscillation, and care should be taken when operating in 2-pole mode, so as not to cause damage to any sound reinforcement equipment to which the synthesizer may be connected.

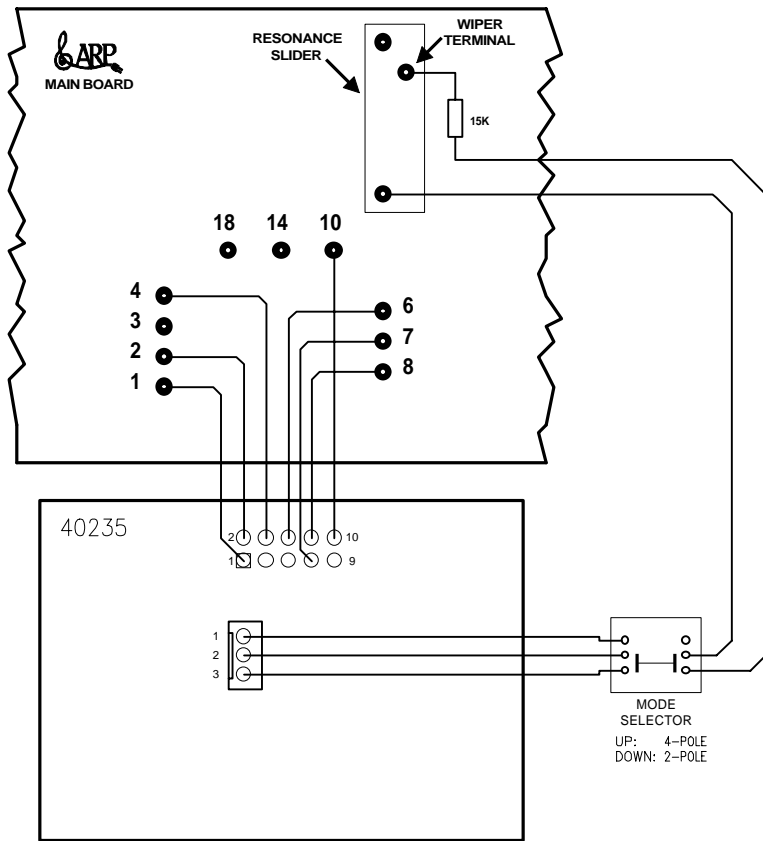
Parts List

BILL OF MATERIALS

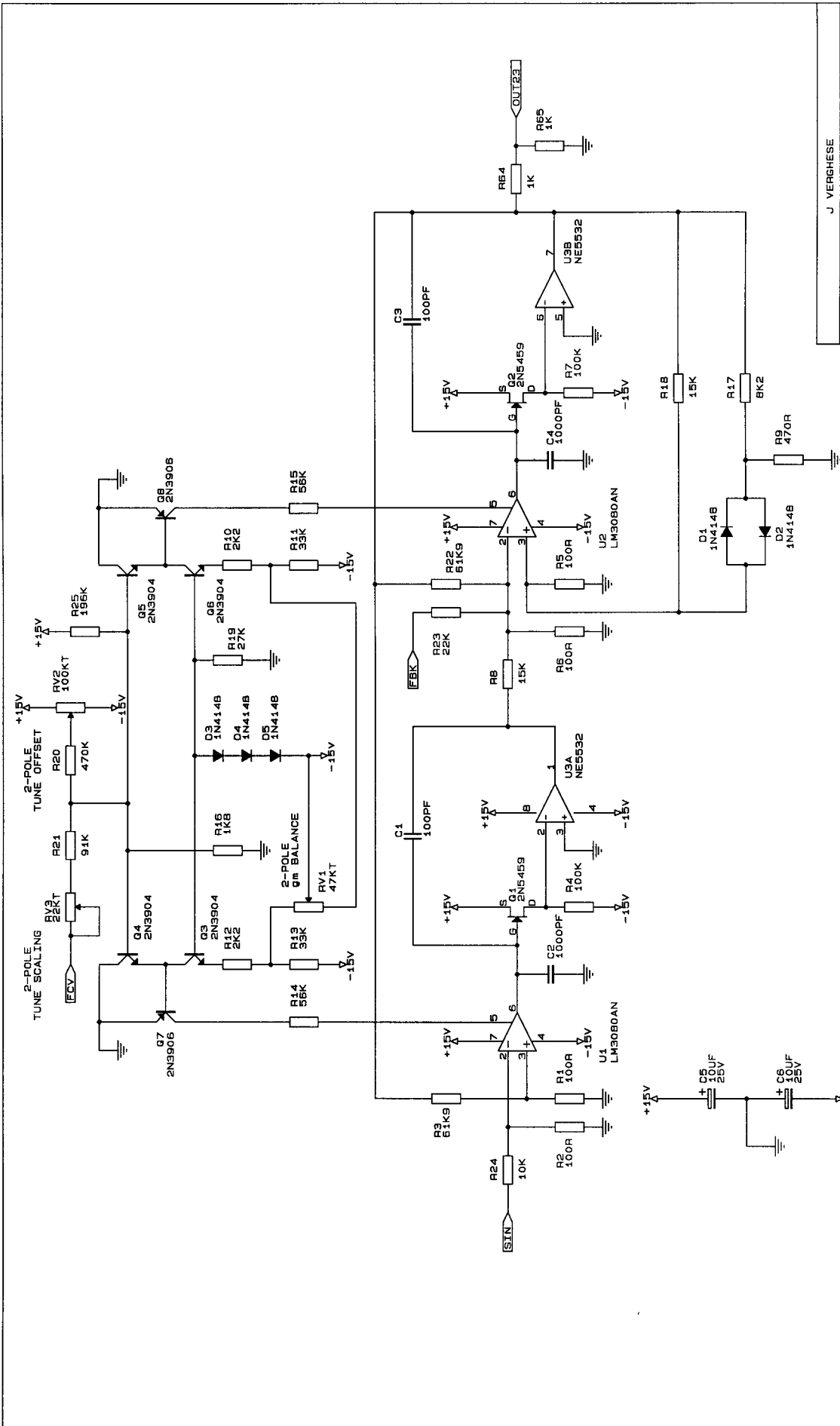
40235.PCB

NOTE: All resistors are 1% 0.25W metal film

Quantity	Package	Value	Components
2	CAP0.2	100PF/POLY/5mm	C1,C3
5	CAP0.2	10NF/POLY/5mm	C10,C16,C7,C8,C9
2	ELEC0.1	10UF25V/RADIAL	C11,C12
4	CAP0.2	100NF/CER/5mm	C14,C15,C17,C18
2	CAP0.2	1000PF/POLY/5mm	C2,C4
2	TANT0.2	10UF35V/TANT	C5,C6
5	DIODE0.3	1N4148	D1,D2,D3,D4,D5
1	MOLEX3	22-27-2031	JP1
1	IDC10	BOX PCB HEADER	JP3
4	TO92-DSG	2N5459	Q1,Q10,Q2,Q9
4	TO92-EBC	2N3904	Q3,Q4,Q5,Q6
2	TO92-EBC	2N3906	Q7,Q8
4	AXIAL0.4	100R	R1,R2,R5,R6
2	AXIAL0.4	2K2	R10,R12
2	AXIAL0.4	33K	R11,R13
8	AXIAL0.4	56K	R14,R15,R38,R39,R46,R55,R60, R61
4	AXIAL0.4	1K8	R16,R37,R45,R54
1	AXIAL0.4	8K2	R17
3	AXIAL0.4	15K	R18,R34,R8
1	AXIAL0.4	27K	R19
1	AXIAL0.4	470K	R20
1	AXIAL0.4	91K	R21
2	AXIAL0.4	61K9	R22,R3
1	AXIAL0.4	22K	R23
1	AXIAL0.4	10K	R24
1	AXIAL0.4	196K	R25
4	AXIAL0.4	470R	R26,R28,R29,R9
2	AXIAL0.4	3K9	R27,R44
7	AXIAL0.4	1K	R30,R31,R47,R48,R53,R64,R65
1	AXIAL0.4	820R	R32
3	AXIAL0.4	150K	R33,R36,R63
1	AXIAL0.4	330K	R35
3	AXIAL0.4	100K	R4,R51,R7
2	AXIAL0.4	787K	R40,R41
2	AXIAL0.4	10K7	R42,R43
6	AXIAL0.4	3K3	R49,R50,R56,R57,R58,R59
2	AXIAL0.4	47K	R52,R62
1	TRIMPOT-ST	64W-50K	RV1
1	TRIMPOT-ST	64W-100K	RV2
1	TRIMPOT-ST	64W-20K	RV3
1	TRIMPOT-ST	64W-100R	RV4
2	DIP8	LM3080AN	U1,U2
3	DIP8	NE5532	U10,U3,U8
4	DIP14	CA3086	U4,U5,U6,U7
1	MOLEX3	22-01-2035	HOUSING
3	MOLEX	08-050-0032	CRIMP TERMINAL
1	IDC10		FEMALE IDC SKT
1			DPDT SWITCH
			FLAT CABLE, EQUIPMENT WIRE, STAND-OFFS, SCREWS

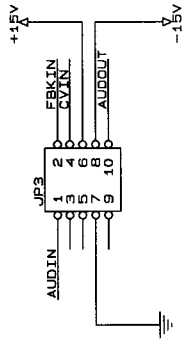
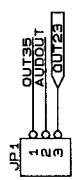
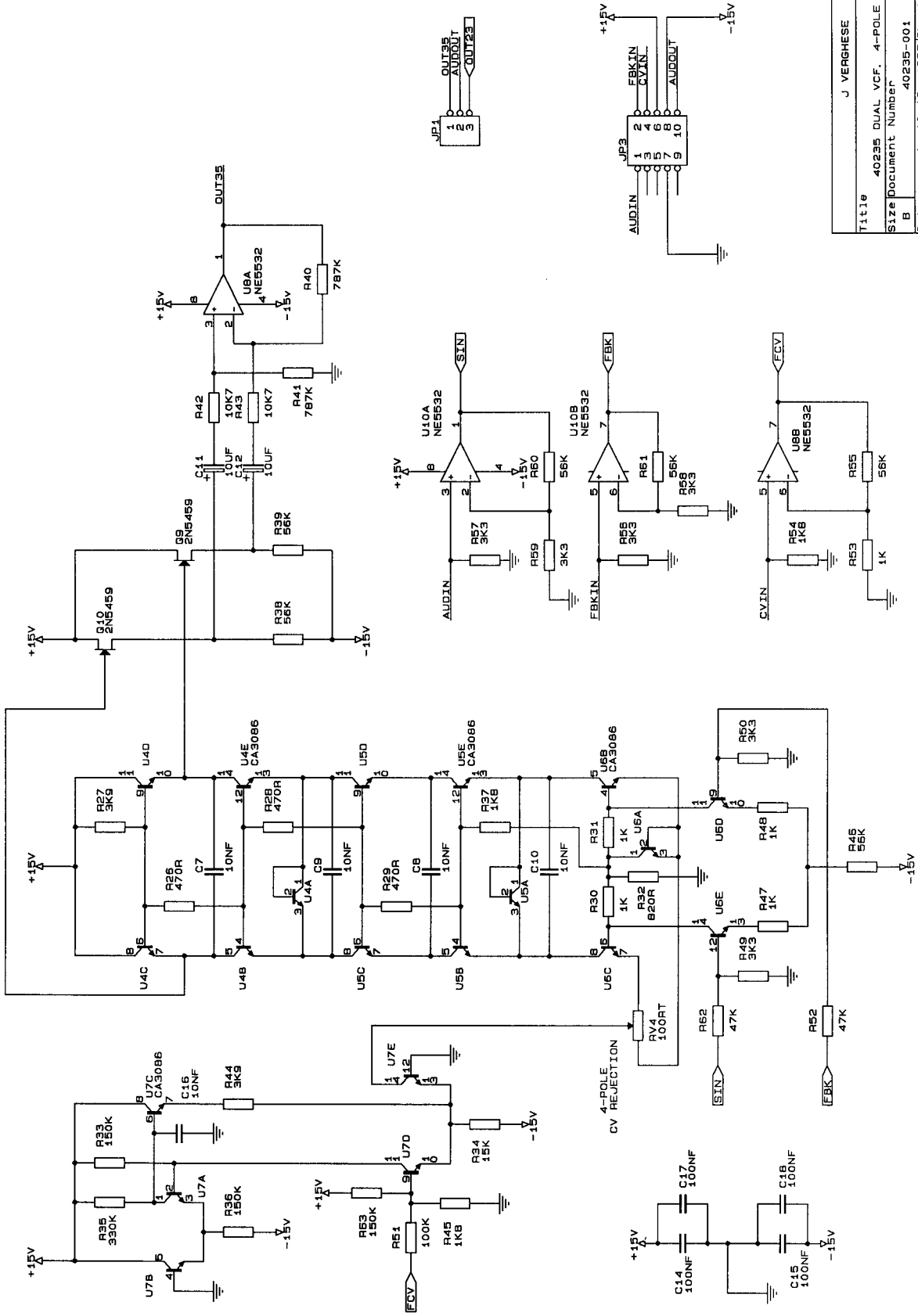


40235 WIRING DIAGRAM



Title		40235 DUAL VCF - 2-POLE SECTION	
Size	Document Number	40235-001	
B	REV	A1	
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Title		40235 DUAL VCF. 4-POLE SECTION	
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B			A1
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