SAF Drives Inc.

Installation & Operating Procedures

CA379

ISOLATOR CARD

SAF Drives Inc.
www.safdrives.com
18 Neville St., Unit C, New Hamburg, ON N3A 4G7

CA379 Circuit Description

OVERVIEW

The CA379 isolator card provides galvanic isolation for signals having high common mode voltages to either earth grounds for floating low voltage signal circuits. Common mode rejection is 100dB for all gain configurations and voltage isolation is +/- 1000 Volts. Leakage current from input to output is less than 5 microamperes.

NOTE:

Maintenance of high voltage isolation capability predicates physical mounting and wiring precautions. All voltage creepage, voltage clearance, and wire insulation ratings must be provided and maintained for both electrical and mechanical considerations. Check the required electrical codes (CSA, NEC, VDE, etc.) for the correct distances to be provided.

The isolator must be supplied with 110/120 VAC, 50/60Hz (35 Volt-Amperes). Terminal connections are L1 and L2. L2 must be connected to an earth ground neutral to comply with electrical codes. L1 is protected with an integrally mounted 1 Ampere, 250 Volt fuse.

HIGH VOLTAGE INPUT

USE EXTREME CAUTION WITH THE HIGH VOLTAGE INPUT SECTION. DO NOT CHANGE THE INPUT GAIN MOLEX WITH HIGH VOLTAGE PRESENT ON THE INPUT TERMINALS. DO NOT ATTEMPT TO CHANGE RG1 AND RG2 CALIBRATION RESISTORS WHEN HIGH VOLTAGE IS PRESENT ON THE INPUT TERMINAL BOARD, IN1 AND IN2.

The input section is galvanically isolated from other functions and sections. Transformer coupling is employed to eliminate the design compromises that are necessary when optical isolation is used. Isolated power supplies are not necessary for the input section. Both signal and power isolation are provided internally for the input section. There are no long-term parameter shifts during sustained common-mode stress. The internally generated carrier frequency is 25kHz.

Large gain modifications are made by using variable impedances in the input section. Input gain can either be 55.6 or 1 unless series current limiting resistors are added on the provided terminal locations RG1 and RG2 to reduce the input gain to less than one. All large gain changes must be made at the input section to take advantage of common-mode rejection. No input zero adjustments are necessary.

The input section must not be directly driven by voltages in excess of +/- 5 VDC (PEAK). For voltages in excess of +/- 5 VDC, series resistances are added on the provided terminal locations marked RG1 and RG2.

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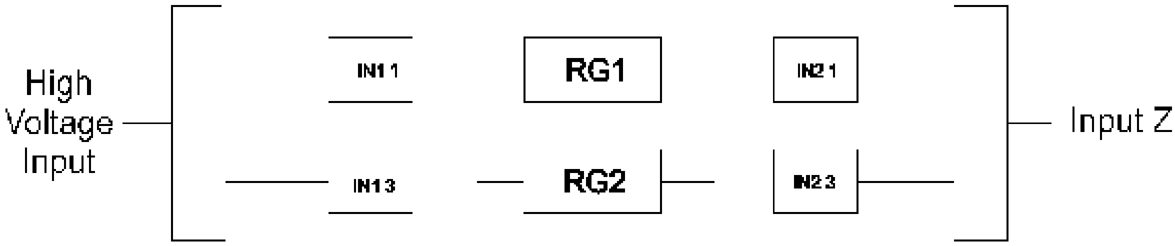
Two resistors are used; however, it is possible to mount four resistors so that any one pair is connected in parallel. Calculation for the total necessary additional impedance is:

(High Voltage – 5 Volts) = Additional resistance (kOhms)

For example, a 500 VDC motor armature is monitored. The necessary additional resistance is 495 kilohms (If 500 kOhms are used, the error is 1%). The two resistors, RG1 and RG2, need not be equal. However, they should be made as nearly equal as is possible to distribute the common-mode voltage into the input



section.

The input section can operate directly from either 50 millivolt or 100 millivolt current sensing shunts. A jumper position converts the input gain from G=1 to G=55.6. A 50 millivolt signal multiplied by 55.6 results in 2.78 volts at the output of the isolation module. The output section gain is adjustable (RV3) from 0.75 to 3 so that the output voltages are available from 2.09 VDC to 8.3 VDC. When using the isolator as a link in a feedback loop, care must be taken to ensure that the input or output section is not driven into saturation. Maximum voltage into the input section is +/- 5 VDC (PEAK).

The input section can be modified to act as an isolated process variable current loop sensor. The function performed is current-to-voltage conversion. RG1 and RG2 become wire jumpers and a 270 Ohm resistor is installed, in parallel, across the input. The input section jumper is installed for G = 1. Input section impedance, in this mode, is 5kOhms. Five kOhms in parallel with 270 Ohms results in an input impedance of 256 Ohms.

EXAMPLE: 4 to 20 milliampere control loop

.004 amp x 256 Ohms = 1.024 Volts
.020 amp x 256 Ohms = 5.120 Volts
Current change = 0.016 Amperes
Input voltage change = 4.096 Volts

Sufficient output gain and offset are available to convert this signal to a signal operating from 0 to +10 VDC. Assure that the process current loop transmitter has sufficient voltage compliance to operate over its entire range into a 256 Ohm load.

OUTPUT SECTION

Two offset ranges are provided: +125 millivolts and +2.0 Volts. Offset range is jumper selected, LO or HI. Low offset range is used when zero output voltage must equal zero input current. High offset range is used to offset output voltages produced by greater than zero input currents when operating as a current-to-voltage converter. See the example given previously for a 4 to 20 milliampere current loop.

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Output gain adjustment (RV3), is 0.75 to 3. Output voltage may be calculated by:

Input Gain x Input Volts x Output Gain = Output Volts

For example, a 240 VDC motor armature is monitored. The input Molex is installed for an input gain of 1. RG1 and RG2 each equal 120 kOhms (Error = 2%). The input voltage to the isolator is 4.899 Volts. If the output requirement is 5 VDC, then output gain is adjusted to 1.021. (A gain of 2.041 can supply 10 VDC at the output Terminals 1 and 2).

Assure that sufficient output voltage overhead is available for servo control characteristics when the isolator is used as a feedback link. For example, thyristor drives supplying phase controlled, rectified voltage to DC motors have voltage peaks that are nearly 200% of the average DC motor voltage. Attempts to use the full +10 VDC output voltage with such applications will result in incorrect output voltages if one considers the peak to average ratio and possible feedback over-shooting when the loop is under damped.

Output voltage compliance is +10 VDC @ +70 milliamperes. The output amplifier can supply power demands as high as 700 milliwatts but operation into loads requiring more than +70 milliamperes will result in output current limiting. Do not operate into a sustained short circuit.

The output signal can be modified (1^{st} order lag) with respect to the isolator bandpass characteristics. Maximum bandpass is 6500 radians per second (1kHz) and minimum bandpass is 424 radians per second (67 Hz). The bandpass is continuously adjustable between these two values. Bandpass is maximum when BPASS, RV1, is adjusted fully counter-clockwise (0%). The steady state output signal polarity is equal to the input polarity of RG1. Output signal inversions, when necessary, can be performed by using diametric input connections.

Two bode charts, Figures 1 and 2 show the magnitude and phase angle displacement for both bandpass extremes. Adjusted gain is not affected until the 0 dB crossover shown on the magnitude chart. Bandpass is defined as the range from DC (0Hz) to the –3 dB point.

Bandpass restriction may cause difficult control problems when the isolator is used as a feedback link. Maximum bandpass should be used unless it is known that feedback phase lag is tolerable. An exception to this rule exists when the CA379 isolator is used as a feedback link for armature voltage regulators. Bandpass limiting can assist, at times, in stabilization of armature voltage regulators. The feedback phase lag appears (armature voltage averaging) as a transfer function lead in the voltage regulator forward transfer function and improves the DC motor CEMF response. Voltage regulator response seldom exceeds 50 radians per second, even in continuous conduction modes, with thyristor converters that supply rectified power to wound field DC motors.

Isolated DC voltages, +15 VDC, Term. 5 and –15 VDC, Term. 3 are available for external use. The sum total of the currents taken from the two voltage supplies may not exceed 100 milliamperes minus the current used by the isolator output signal on Term.1. For example, when the isolator signal output uses 25 milliamperes, the sum of the currents from the +15 VDC and –15 VDC supplied is 75 milliamperes. Do not exceed these maximums. Two light-emitting diodes, LD1 and LD2, annunciate the presence of regulated power.

A power supply monitor relay is provided. When the isolator is used as a feedback link, the voltage relay contacts must be connected into a fault circuit in order to sense power failure to the isolator. The relay is energized for normal operation. An isolated Form-C contact is provided on terminals N/O, N/C, and TOG. The relay contacts are rated for 120VAC, 1 ampere resistive, and 240VAC, .5A resistive.

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SPECIFICATIONS:

Common-Mode Isolation:	+1000 Volts
Non-Linearity:	0.05% Maximum (Input Gain = 1)
Common-Mode Rejection (CMR):	@60 Hz = 100dB
Input impedance:	5000 Ohms resistive (G = 1)
	173 Ohms resistive (G = 55.6)
Bandwidth: Minimum	- 424 radians per second
Maximum	- 6500 radians per second
Offset Voltage:	Zero to +2 VDC
Rated Output Voltage:	+10 VDC
Rated Output Current:	+/- 70 milliamperes
Rated Operating Temperature:	Zero to 70 deg. C
Storage Temperature:	- 40 deg. C to +85 deg. C

Input Power:	110/120 VAC, 50/60Hz, 35 Volt-Amperes
	+10%, -5% of rated AC Voltage
Output Power:	+15 VDC, 100 milliamperes (Minus the output current)
	Regulation – 0.5%

Physical Size: 3-1/4” wide, 8-5/8” long (Can be snap-track mounted)

TERMINALS:

AC Input Power:	L1 and L2
DC Output Power:	+15 VDC, Terminal 5
	-15 VDC, Terminal 3
	Zero Common, Terminal 4
Signal Output:	Signal, Terminal 1
	Zero Common, Terminal 2
Signal Input:	Terminal Position IN1 (RG1 and RG2)
	RG1 and RG2 connect to Terminals IN2
Jumper Positions:	Input: G = 1 and G = 55
	Offset: LO and HI

TEST PROCEDURES:

1. Set BPASS, RV1, fully clockwise.
2. Install a 15 kOhm resistor in the RG1 position.
3. Install a zero Ohm resistor in the RG2 position.
4. Install a jumper from the power supply common Term. 4 to the RG2 input terminal.
5. Install input jumper on G = 1 position.
6. Install offset Molex on LO offset position.
7. Connect 120 VAC power to L1 and L2.
8. Turn on 120 VAC power.
9. Observe that relay K1 is energized. Check normally-open contacts, N/O to TOG, for continuity.

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10. Connect a voltmeter to the output terminals. Positive voltmeter probe to the output Term.1, negitive voltmeter probe to the common Term. 2.
11. Adjust OFFSET, RV11, for zero (+1 millivolt) voltmeter reading.
12. Install a jumper from the +15 VDC Term. 5, to the RG1 input terminal.
13. Adjust GAIN, RV3, to minimum, voltmeter reads +2.8 VDC.
14. Adjust GAIN, RV3 to maximum, voltmeter reads +11.2 VDC.
15. Reverse jumper connections to the input terminals.
16. Voltmeter reads –11.2 VDC.
17. Adjust GAIN, RV3, for –3.76 VDC voltmeter reading.
18. Remove 120 VAC power.
19. Jumpers remain on installed positions.
20. Remove all wire jumpers and 15K resistor.