



RFL Electronics Inc.

# INSTRUCTION DATA

## Model 66 IN/OPI 8-Point Input/Optical Isolation

### DESCRIPTION

The Model 66 IN/OPI (Figure 1) is one of the RFL 66 TDMS Series of pug-in modules. Its purpose is to provide up to 2500 volts of isolation between the input terminals and the output terminals. Each input has a rectifier, so either positive or negative inputs can be accepted. In addition, current limiting resistors can be supplied with each module or mounted externally for adapting the Model 66 IN/OPI to any available input voltage. An optional shift register may be installed on the board to interface directly with the Encoding Controllers.

### SPECIFICATIONS

**No. of Inputs:** 8

**Max. Input Current:** 50 mA into any input terminal.

**Min. Input Current:** 10 mA to assure a logic 1 at the output.

**Response Time:** The output shall change state within 2 mS of an input change.

**Isolation Voltage:** 2500V. Meets SWC requirements of IEEE Std. 472-1974.

**Ambient Temperature:** -30 to +70°C.

**Power:** 11 to 13V dc at 9 mA max.

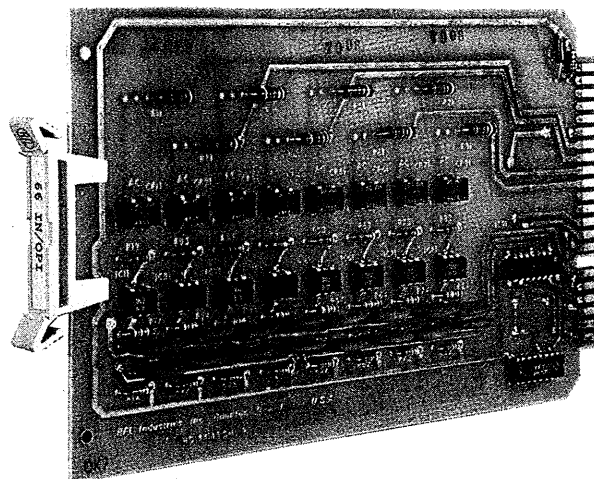


Figure 1. Model 66 IN/OPI 8-Point Input/Optical Isolation Module.

**Size:** Two standard one-half-inch module spaces in an RFL Model 68 Chassis.

### DIFFERENCE BETWEEN MODULES

The Model 66 IN/OPI module is available with several combinations of options, as listed in Table 1. The module Designation appears on the module handle.

Table 1  
Differences Between Modules - Model 66 IN/OPI Input Optical Isolator

Module Designation	Circuit Card HB-44140	Options					
		Shift Register HB-44146	Input Series Resistors				
			None * HB-44147-1	For 24V Input HB-44147-2	For 48V Input HB-44147-3	For 125V Input HB-44147-4	For 12V Input HB-44147-5
66 IN/OPI-1	•		•				
66 IN/OPI-2	•			•			
66 IN/OPI-3	•				•		
66 IN/OPI-4	•					•	
66 IN/OPI-5	•	•	•				
66 IN/OPI-6	•	•		•			
66 IN/OPI-7	•	•			•		
66 IN/OPI-8	•	•				•	
66 IN/OPI-10	•	•					•

\* - Jumpers are installed on the circuit card in place of the input series resistors. External resistors must be used to limit all inputs to 50 mA maximum. (See Installation section for additional information).

## INSTALLATION

### CAUTION

Model 66 IN/OPI modules with the optional shift register contain CMOS circuitry, requiring special handling precautions. Refer to "CMOS Handling Precautions" (DRFL Document 12175) for further information.

All unused input terminals which are internally connected to CMOS circuitry must be connected to either +V or circuit common.

**Space Requirements:** Model 66 IN/OPI modules require two module spaces in a Model 68 Chassis. The mating connector used must have a key in position 16 (T).

**Interconnections:** Connect all interconnect wiring to the mating connector as shown in Figure 2.

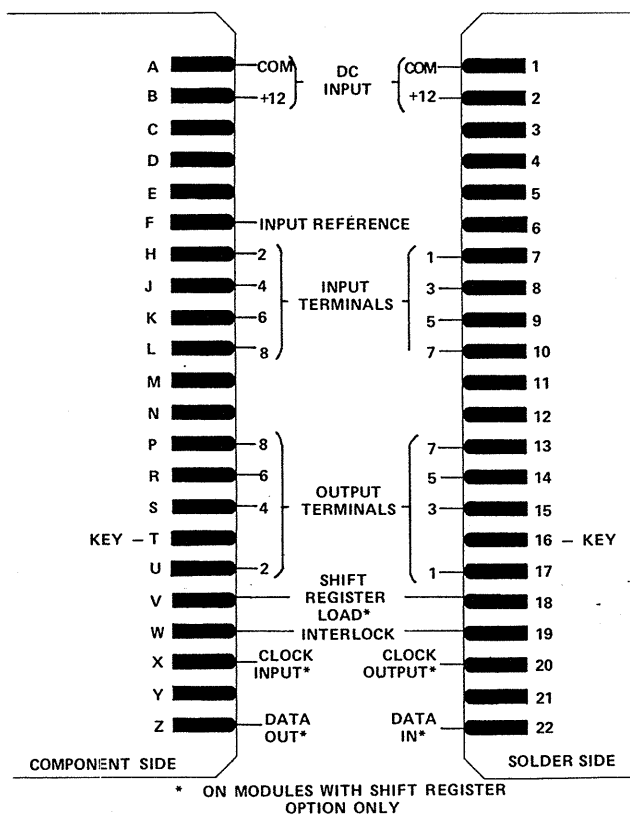


Figure 2. Edge connector terminal assignments, Model 66 IN/OPI Input/Optical Isolation Module.

**Input Resistor Selection (Models 66 IN/OPI-1 and 66 IN/OPI-5 Only):** Model 66 IN/OPI-1 and 66 IN/OPI-5 modules require the use of resistors connected in series with each input. These resistors may be installed directly on the circuit card, or they may be placed in series with each input line.

### CAUTION

In applications where several inputs may be continuously activated too much heat may be dissipated on the circuit card. It is recommended that only two or three watts per card be dissipated for 66 IN/OPI modules mounted in a Model 68 Chassis. If more than three watts will be dissipated, the series resistors must be mounted outside the chassis. The terminal strips on the rear of the chassis is a suitable place for mounting these resistors.

### NOTE

Before resistance values can be calculated the minimum and maximum input voltages must be known.

Input resistors are selected for an input current of at least 10 mA at the minimum input voltage. Resistor power ratings are based upon the resistance value and the maximum input voltage; resistors used should be rated for at least twice the calculated power dissipation.

$$R = \frac{(E_{in \text{ min}} - 3)}{0.01}$$

$$P = \frac{(E_{in \text{ max}} - 3)^2}{R}$$

Where R = Calculated input series resistance in ohms

P = Calculated power dissipation in watts

$E_{in \text{ min}}$  = Minimum input voltage

$E_{in \text{ max}}$  = Maximum input voltage

Example: Input voltage will be derived from a source that will vary between 42 and 56 volts.

$$R = \frac{(42 - 3)}{0.01} = \frac{39}{0.01} = 3900 \text{ ohms}$$

$$P = \frac{(56 - 3)^2}{3900} = \frac{(53)^2}{3900} = \frac{2809}{3900} = 0.72 \text{ watts}$$

In this example, a 3,900 ohm, 1.5 watt resistor would be used in series with each input.

**Shift Register Connections (Models 66 IN/OPI-5 through -10 Only):** Model 66 IN/OPI modules with the optional shift register must be connected to the Encoding Controllers being used in the particular system. Refer to the Instruction Data Sheet for the Encoding Controllers for further information.

## THEORY OF OPERATION

### Overview

The Model 66 IN/OPI Input/Optical Isolation Module (shown in schematic form in Figure 3) is used to provide up to 2,500 volts of isolation between its input and output terminals. To do this, each module contains eight independent input isolation circuits. In addition, some modules contain an optional shift register for direct interface with other modules in the TDM system.

### Input Isolation Circuits

The input isolation circuits accept input voltages, rectify them, and apply them across optical isolators. The outputs of these isolators are available at the module edge connector. On some modules, these outputs are used as input signals for the optical shift register.

All input voltages are applied across the input terminals and terminal F (INPUT REFERENCE). Input voltages may be either positive or negative. Input series resistors R11, 21, 31, 41, 51, 61, 71, and 81 (or the external resistors which may be used with some modules) limit the input current to a safe level.

Bridge rectifiers CR11, 21, 31, 41, 51, 61, 71, and 81 convert all input signals to the proper polarity to

light the input LED of optical isolators IC11, 21, 31, 41, 51, 61, 71, and 81. These isolators have phototransistors on their outputs. When the input LED's light, the phototransistors conduct, causing their output terminals to go positive.

The resistors and capacitors connected between the phototransistor base and emitter (and from the emitter to ground) provide biasing and spike suppression.

### Shift Register (Optional)

The optional shift register is used to convert the eight independent outputs generated by the input isolation circuits to a single serial output. This serial output can be fed directly to the Encoding Controller for transmission.

Several 66 IN/OPI modules can be connected in a "daisy-chain" by wiring the DATA IN and DATA OUT terminals (22 and Z respectively) in series. In this case, data will shift along the common data line one bit at a time upon receipt of clock pulses at CLOCK INPUT terminal X. Two inverters from hex/inverter buffer IC92 are used to boost the clock signal, so additional modules can be driven by it.

**Table 2**  
**Replaceable Parts**

Circuit Symbol (See Figure 3)	Description	Part Number
<b>Model 66 IN/OPI Input/Optical Isolator Module - Assembly No. HB-44140</b>		
C11, 12, 21, 22, 31, 32, 41, 42, 51, 52, 61, 62, 71, 72, 81, 82	Capacitor, ceramic, 0.022 $\mu$ F, 20%, 50V, AVX SA205C223MAA or equiv.	1007 1597
C91	Capacitor, tantalum, 4.7 $\mu$ F, 20%, 20V, Kemet T322B475M020AS or equiv.	1007 711
CR11, 21, 31, 41, 51, 61, 71, 81	Bridge rectifier assembly, 60V, 1A, 4-pin DIP package, Varo Semiconductor VM08 or equiv.	46371
IC11, 21, 31, 41, 51, 61, 71, 81	Optically-coupled isolator, phototransistor output, Texas Instruments TIL114 or equiv.	41083
R11, 21, 31, 41 51, 61, 71, 81,	Resistor, value and type dependent upon model: For 66 IN/OPI-1, 66 IN/OPI-5; Jumper wire, 22 AWG, 0.500 x 0.250 inches, Fancort Industries J-0.500X0.250-T22 or equiv.	90787 7
	For 66 IN/OPI-2, 66 IN/OPI-6; Resistor, metal film, 1.82K, 1%, 1/4W, Type RN1/4	0410 2313
	For 66 IN/OPI-3, 66 IN/OPI-7; Resistor, composition, 3.9K, 5%, 2W, Allen-Bradley HB Series or equiv.	1009 1032
	For 66 IN/OPI-4, 66 IN/OPI-8; Resistor, wirewound, 10K, 5%, 3.25W, Ohmite 4454 Style 995-3A or equiv.	1100 403
R12, 22, 32, 42, 52, 62, 72, 82	Resistor, metal film, 12.1K, 1%, 1/4W, Type RN1/4	0410 1392
R13, 23, 33, 43, 53, 63, 73, 83	Resistor, metal film, 1K, 1%, 1/4W, Type RN1/4	0410 1288
R14, 24, 34, 44, 54, 64, 74, 84	Resistor, metal film, 475K, 1%, 1/4W, Type RN1/4	0410 1545
R91	Resistor, metal film, 12.1K, 1%, 1/4W, Type RN1/4	0410 1392
<b>Shift Register - Option HB-44146</b>		
IC91	MOS 8-stage static shift register, RCA CD4021BE or equiv.	0615 36
IC92	MOS hex inverter/buffer, RCA CD4049AE or equiv.	0615 7

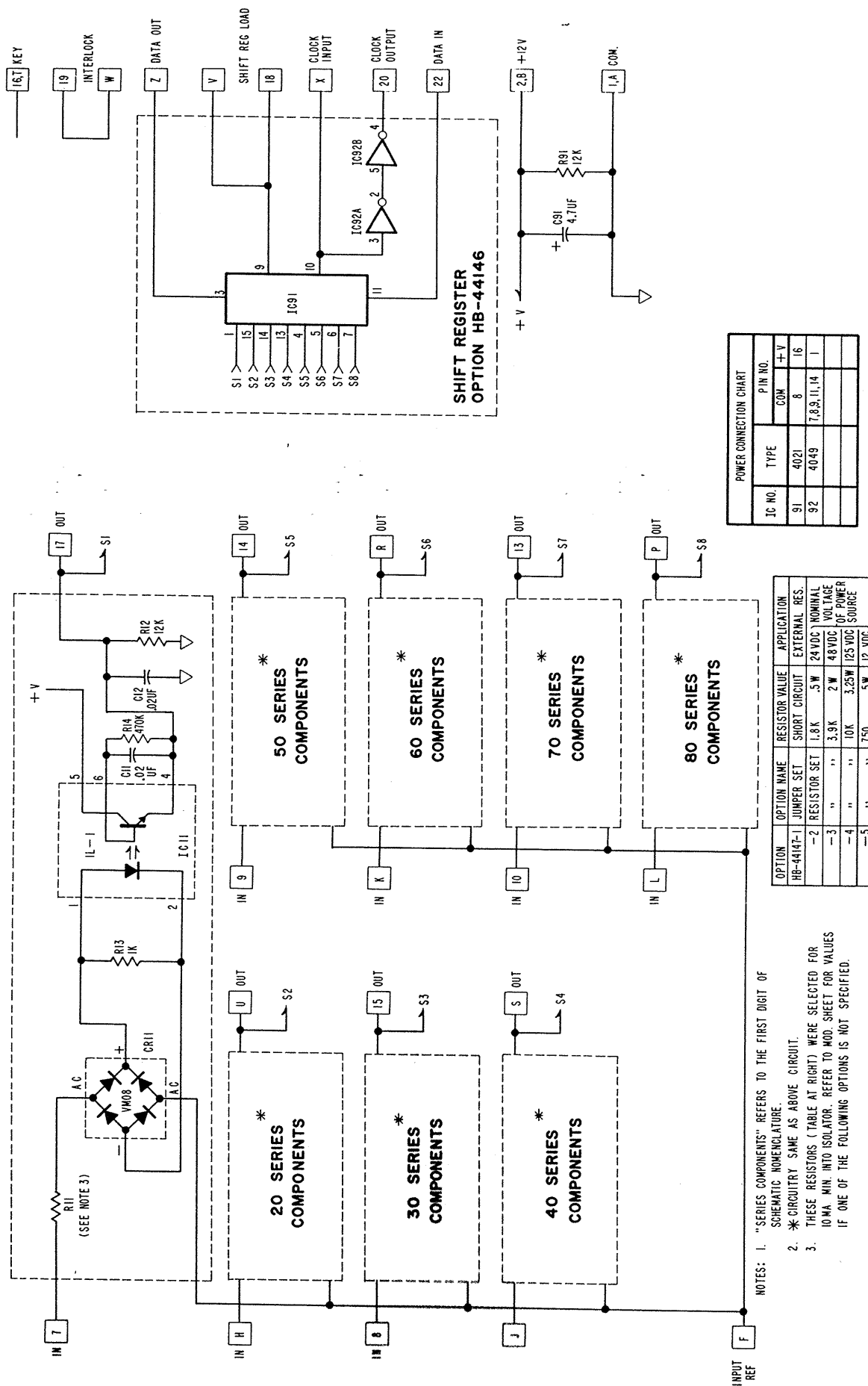


Figure 3. Schematic - Model 66 IN/OPI Input/Optical Isolation Module (HD-44144).