DIM1
Digital Input Module 1

The DIM1 Digital Input Module provides 16 channels of digital input with resistor programmable thresholds from +5 to +28V. As shipped, the module is configured for 5V TTL inputs. Each channel can be optically isolated from system circuitry and other input channels. The settling time of the isolation circuit is 5μsec, allowing sampling of high-speed digital inputs.

All connections are made to on-card screw terminals which accept 16-24 gauge wire leads.

The DIM1 module can be installed in any available slot in the system. To install the module, insert it into the slot connector with the component side facing the power supply. Generally, digital modules should be placed in the high-numbered slots if any analog modules are present.

CAUTION: Always turn off the baseboard power before installing or removing modules. To minimize the possibility of excessive EMI radiation, replace and secure the top cover before operating the unit.

User-Configured Components

Resistors R101-R116 can be configured by the user to provide a variety of input thresholds, permitting the connection of digital inputs from +5V to +28V DC. The module is shipped with 270Ω resistors already installed, allowing TTL level inputs on all input channels. See Table 1 for user-configured components on the DIM1 module.

There is one bank of screw terminals at the top of the DIM1 module. 32 screw terminals for the positive and negative inputs for each channel on the module as well as +5V and ground. These terminals accept 16-24 gauge wire stripped 3/16 of an inch. Figure 1 shows the locations of these components. In addition, two jumper networks, W101 and W102, connect the + terminals of the inputs together.

Table 1. User-Configured Components on the DIM1 Module

Component	Designation	Function
Resistors	R101-R116	Voltage programming resistors for each input channel
Screw Terminals	J136	Positive and negative input connections
+5V, GND	Terminals	Internal power supply connections
Jumper Network	W101	Connects + inputs of channels 0-7 together
Jumper Network	W102	Connects + inputs of channels 8-15 together

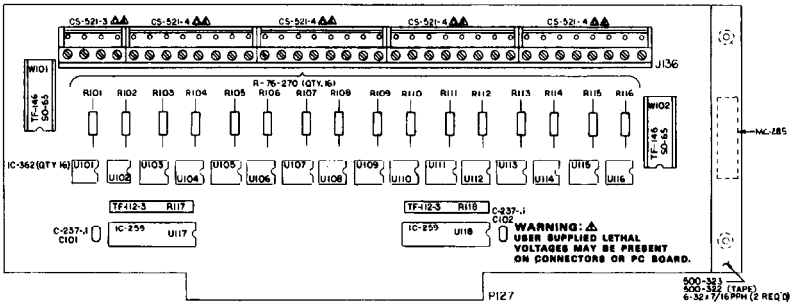


Figure 1. DIM1 Module Configuration

Connections

The connecting terminals are located along the top edge of the module board (J136). The channel numbers and +5V and ground connections are marked on the board.

WARNING: Lethal user-supplied voltages may be present on the terminals. Use extreme caution when handling live circuits.

To minimize the possibility of EMI radiation, it is recommended that shielded cable be used for input connections. One end of the shield should be left disconnected. In this configuration the shield cannot be used as one of the signal-carrying wires.

Non-Isolated Connections

As shipped, two jumpers, W101 and W102, are installed on the module. W101 connects the + terminals of channel 0 through 7 while W102 connects the + terminals of channels 8 through 15. To connect non-isolated inputs, connect a jumper from the +5V power module supply to the + terminal of one channel in each bank (channels 0 and 8, for example). Input signal high would then be connected to the (−) terminal of the channel in question, while input signal low should be connected to the module ground terminal. See Figure 2 for an example of module connections. Note that with this configuration, a single DIM1 module draws 280mA from the baseboard +5V supply. Since that supply is limited to 3A, care should be taken when using many modules in the system.

CAUTION: The +5V power supply is not protected. Shorting the +5V terminal to ground will cause the system to malfunction.

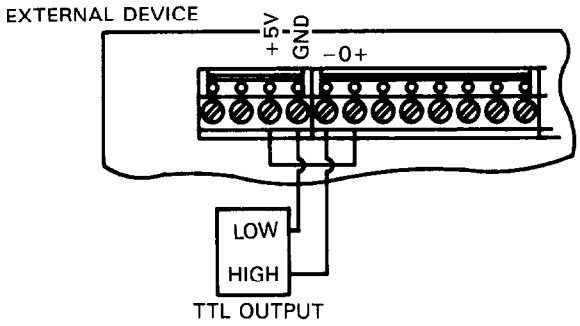


Figure 2. Typical Non-isolated TTL Connections

Isolated Connections

In some cases, one may want to completely isolate the inputs by maintaining the Series 500 system at a ground potential separate from the equipment connected to the DIM1 module. With this configuration, leave W101 and W102 installed but connect the + terminals of channel 0 and 8 to the +5V supply (or other voltage, if so programmed) common to the incoming signals. With this configuration, DIM1 current consumption is reduced to 60mA. Figure 3 shows isolated connections.

CAUTION: Make sure the +5V module supply terminal is not connected to the + input terminals with this configuration. Input signal high should be connected to the – terminal of the desired channel. Note that no ground connection to the module should be made with this configuration.

If channels are to be totally isolated from one another, remove W101 and W102 and connect the external supply voltage for each channel to the individual channel + terminal.

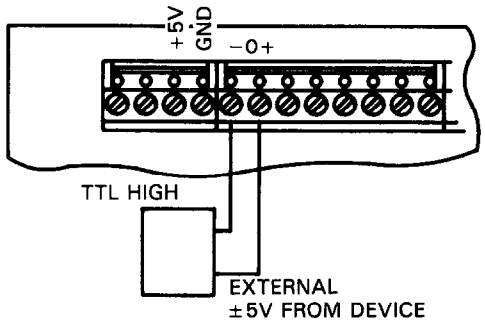


Figure 3. Typical Isolated TTL Connections

Level Modification

Resistors R101-R116 program the voltage for each input channel. Since the inputs are active low, the resistor value determines the voltage threshold when a logic 1 (low input voltage) is read.

TTL-compatible levels are preconfigured by factory-installed resistors of 270Ω on all channels. Higher voltages (up to +28V DC) can be accepted by installing resistors with other values, determined by the formula:

R=(V−1.2)/0.014

Where R is the value of the resistor in ohms, and V is the logic 1 (low input) voltage. This formula is based on Ohm's law, and the amount of voltage and current required to activate the LED.

With TTL logic, any signal less than 0.8V is read as "off" and any signal greater than 4.0V is read as "on". Table 2 summarizes resistor values for commonly used input voltages.

Table 2. Voltage Programming Resistor Values

Voltage	Resistor	Value
+5V	270Ω	1/4W
+10V	680Ω	1/4W
+12V	820Ω	1/4W
+15V	1kΩ	1/2W
+18V	1.2kΩ	1/2W
+20V	1.2kΩ	1/2W
+24V	1.8kΩ	1/2W
+28V	2.2kΩ	1/2W

Commands

DIM1 module commands are listed in Table 3. Table 4 summarizes the locations for slot-dependent commands.

Table 3. Commands Used with the DIM1 Module

Command	Location
DIGITAL A	Slot-dependent CMDA
DIGITAL B	Slot-dependent CMDB

Table 4. Locations for Slot-Dependent Commands

Slot	CMDA	CMDB
Slot 1	CFF80	CFF81
Slot 2	CFF82	CFF83
Slot 3	CFF84	CFF85
Slot 4	CFF86	CFF87
Slot 5	CFF88	CFF89
Slot 6	CFF8A	CFD8B
Slot 7	CFF8C	CFF8D
Slot 8	CFF8E	CFF8F
Slot 9	CFF90	CFF91
Slot 10	CFF92	CFF93

DIGITAL A

Location: Slot-dependent CMDA

The command DIGITAL A is used to read port A (channels 0-7) on the DIM1. This command and location is always read, never written to. When read, DIGITAL A returns an 8-bit binary number, bits 0-7 representing the status of channels 0-7, respectively. See Table 5.

If it is necessary to know the status of a single channel, a logical AND statement can be used in assembly language to mask out the irrelevant bit positions and irrelevant bits. The mask should contain 0's in all irrelevant bit positions and a 1 in the bit position that represents the status of the channel in question. The result will be an 8 bit binary number where each bit is 0 except the one bit that indicates the status of the channel being read.

When reading the DIM1 module from BASIC, it will be necessary to convert the decimal value returned by a PEEK statement into its binary equivalent. The 8 bits of this binary number will reflect the status of a single channel.

The grouping of digital inputs into ports allows data from up to eight channels to be read simultaneously.

Note that the DIM1 module inverts incoming data. If a channel input is high, the respective bit position will be set to 0.

Table 5. Bit Configuration for DIGITAL A

D7	D6	D5	D4	D3	D2	D1	D0
Ch7	Ch6	Ch5	Ch4	Ch3	Ch2	Ch1	Ch0

DIGITAL B

Location: Slot-dependent CMDB

DIGITAL B is the equivalent of DIGITAL A, operating in exactly the same manner, but addressing Port B of the DIM1 (channels 8-15. See Table 6 for configuration.

Table 6. Bit Configuration for DIGITAL B

D7	D6	D5	D4	D3	D2	D1	D0
Ch15	Ch14	Ch13	Ch12	Ch11	Ch10	Ch9	Ch8

Theory of Operation

For the following discussion, refer to schematic drawing number 500-236.

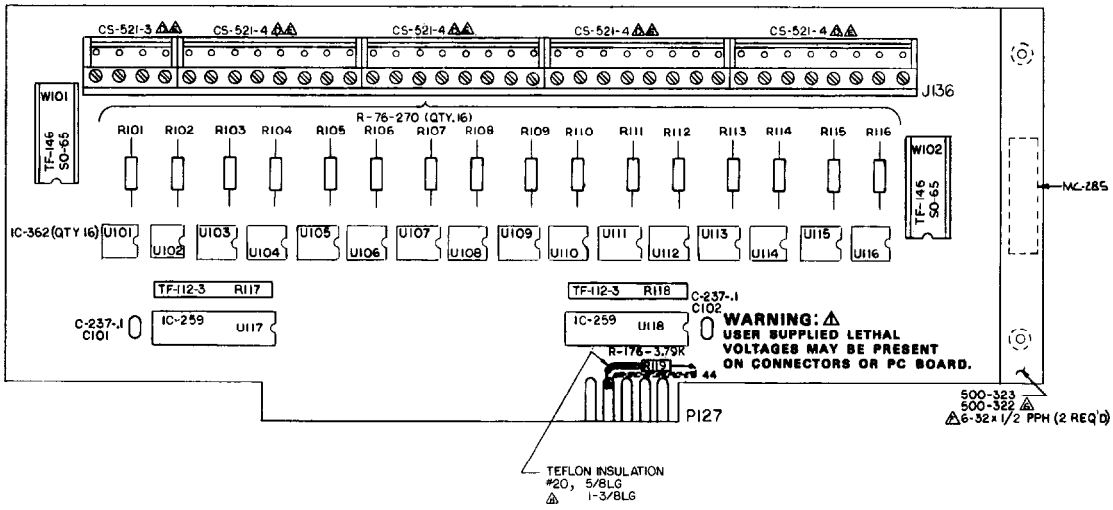
Optical isolators U101-R116 (TIL117) are the primary components of the Digital lnput Module, providing isolated digital sensing for input channels 0-15. Each isolator contains an internal transmitting LED (driven by the input signal) and a receiving photo transistor, which is connected to the output pin of the IC. Pull ups for these outputs are provided by R117 and R118.

The threshold sensitivity of isolators U101-U116 is determined by the values of voltage programming resistors R101-R116, respectively. The DIM1 module is shipped from the factory with 270Ω resistors installed. In this configuration, the DIM1 module will accept standard TTL-level signals. The + terminals of the input channels are connected together by W101 and W102.

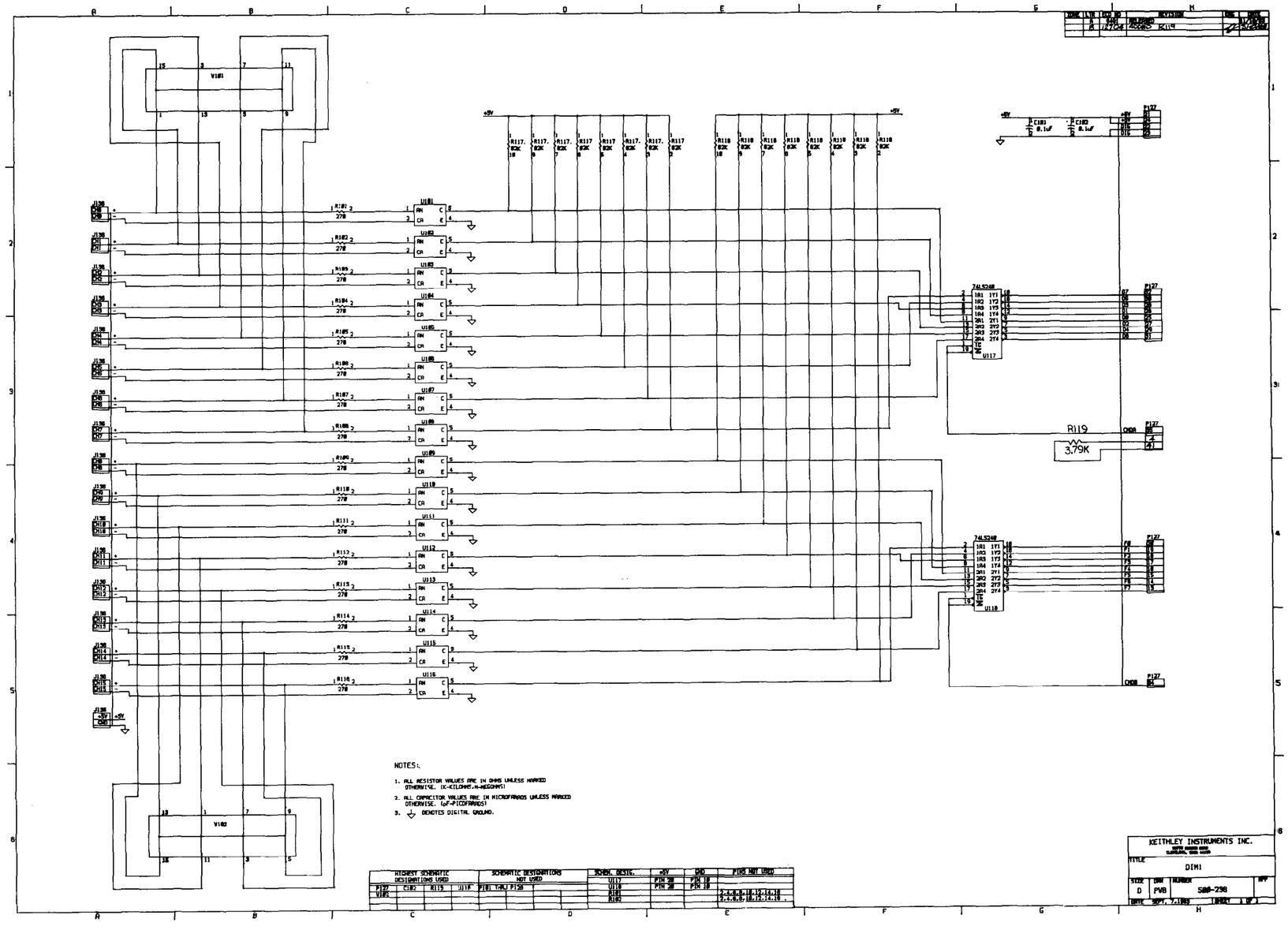
The outputs of U101-U116 drive buffers U117 and U118, two octal inverter, buffers (74LS240). The outputs of U117 and U118 are connected to the data lines (D0-D7 and F0-F7) of the system data bus. port A of the DlM1 module (channels O-7) is directed through U117, and port B (channels 8-15) directed through U118. Enabling of U117 is triggered by command line CMDA, and U118 by command line CMDB.

DIM1 Specifications

Input channels: 16
Input characteristics: TTL compatible, low true Logic 1 drive = 14mA sink at <0.5V
Isolation:
  Technique: optical
  Channel to ground: 500V peak max
  Channel to channel: 0 (jumper plugs installed)
User configurable characteristics:
  Input voltage: up to 28V max
  Channel to channel isolation: 500V peak (jumper plugs removed)
  External supply requirements (for channel to channel isolation): 5 to 28 volts at 14mA per channel



DIM1 COMPONENT LAYOUT



DIM1 SCHEMATIC DIAGRAMS