ANALOG INPUT TO 140-FT H316

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1. INTRODUCTION

This report describes the interface necessary for the 316 computer to input analog data to the 140-ft telescope.

2. PROGRAMMING

OCP 40       Resets the input system to channel zero.

INA 1140     Inputs analog data and steps the input system to read the next channel. There are sixteen channels of data (CH 0 - CH 15). It takes about 45 milliseconds between each INA. At this time some of these channels are not used. The data format for temperature (CH 0) is listed below.

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sign 1 = +</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>100's of degrees C</td>
</tr>
<tr>
<td>5</td>
<td>10's of degrees C</td>
</tr>
<tr>
<td>6</td>
<td>Units of degrees C</td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Tenths of degrees C</td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

Three channels (CH 4, CH 5, and CH 6) contain weather data from the interferometer. Channel 4 is dew point, CH 5 is temperature, and CH 6 is barometric pressure.

3. ANALOG INPUT SYSTEM

The analog input system has two sections (see Figure 1).

One section located in the 316 interface chassis (H316 analog input card) contains an address decoder, 16-bit shift register, and necessary gating to apply the data to the computer input bus.
The other section (DVM multiplexer control) located in the operator's console contains a digital voltmeter, logic to control the DVM, shift register storage, 16-channel analog multiplexer, and analog buffer cards.

4. H316 ANALOG INPUT CARD

This card decodes the address bus and generates the following signals:

- **OCP 40**: This signal is used to reset a binary counter and ready flip-flop. This signal is also used by the DVM multiplexer control card located in the operator's console.

- **INA 140**: This signal resets a binary counter (16) and ready flip-flop. It is also used by the DVM multiplexer control card.

- **AD 140+A/B**: These signals are used to gate the data on the input bus.

This card, in addition to the address decode, contains a 16-bit shift register that receives its data from the DVM control card. A binary counter and ready flip-flop are reset by an OCP 40 or an INA 140. These two signals also cause the DVM to take a reading. When the reading is finished, the data is clocked into the shift register. The clock pulses are counted and on the sixteenth clock the ready flip-flop is set. This enables the 316 to do an INA 140 which starts the cycle again.

5. DVM MULTIPLEXER CONTROL

This card located in A chassis in the operator's console controls a DVM and analog multiplexer (see Figure 2).

The computer can reset a 16 counter by an OCP 40. When the computer does an INA 140 the counter is incremented by one. The DVM control logic will start a conversion on a time share basis with the local readout. This conversion will be started by an OCP 40 or an INA 140.
The local readout conversion is initiated 20 times a second. The address for the local readout is selected by a digi switch.

When a reading was taken for the computer, the data is loaded into a shift register and shifted to the "316 Analog Input Card" at a 20 kHz rate.

6. ANALOG BUFFER CARDS

One "Douglas Card" has space for two analog channels. The analog buffer cards can contain circuitry necessary for interfacing any analog signals. The output of the analog multiplexer is divided by 50. The range of the DVM is $\pm 199.9$ millivolts. The input to the multiplexer should be limited to $\pm 7.5$ volts.

7. TEMPERATURE INPUT

"Temperature sensitive resistors" are used to sense temperature. These resistors have a nominal resistance of 1K ohm at 25°C. These resistors have a positive temperature coefficient.

Each analog circuit has to be calibrated for each resistor. There are two adjustments, one for the resistance value at 0°F (-17.8°C) and one for 100°F (37.8°C). To calibrate the circuit, set in the 0°F value in place of the "TSR" and adjust the -17.8 pot for a -17.8 meter reading on the appropriate channel. Then set the 100°F value and adjust the 37.8 pot for a meter reading of 37.8. These adjustments will have to be made several times as one adjustment affects the other.

We have purchased 25 of these resistors and measured their resistance at 0°F and 100°F for calibration.

Corning Glass Works has discontinued production of these "temperature sensitive resistors".

7. BUFFER CARDS FOR INTERFEROMETER WEATHER DATA

Three lines were run from the interferometer to indicate dew point, temperature, and pressure.

No adjustment is required on these signals. The DVM display can be converted to a meaningful reading by the approximate formulas listed below:

Reading -60 = dew point.
Reading -60 = temperature.
Air Pressure = .1375 reading + 61.25.

8. CREDITS

Credit should be given to Ron Weimer and Jerry Turner for interfacing the interferometer weather data. Credit should also be given to Doreen Morris, R. Skaggs and the Green Bank Machine Shop for their help in constructing this system.
FIG. 5
ALL RESISTORS 1/2

3 CIRCUITS / CARD

WEATHER STATION

CIRCUITS 1-3

LIGHTING PROTECTION

INTER TELSCOPE CABLE

Dew Point

Temp

Pressure

7 pin Amphenol

38 pin

Elco

Elco

INTERFEROMETER

FIG 7