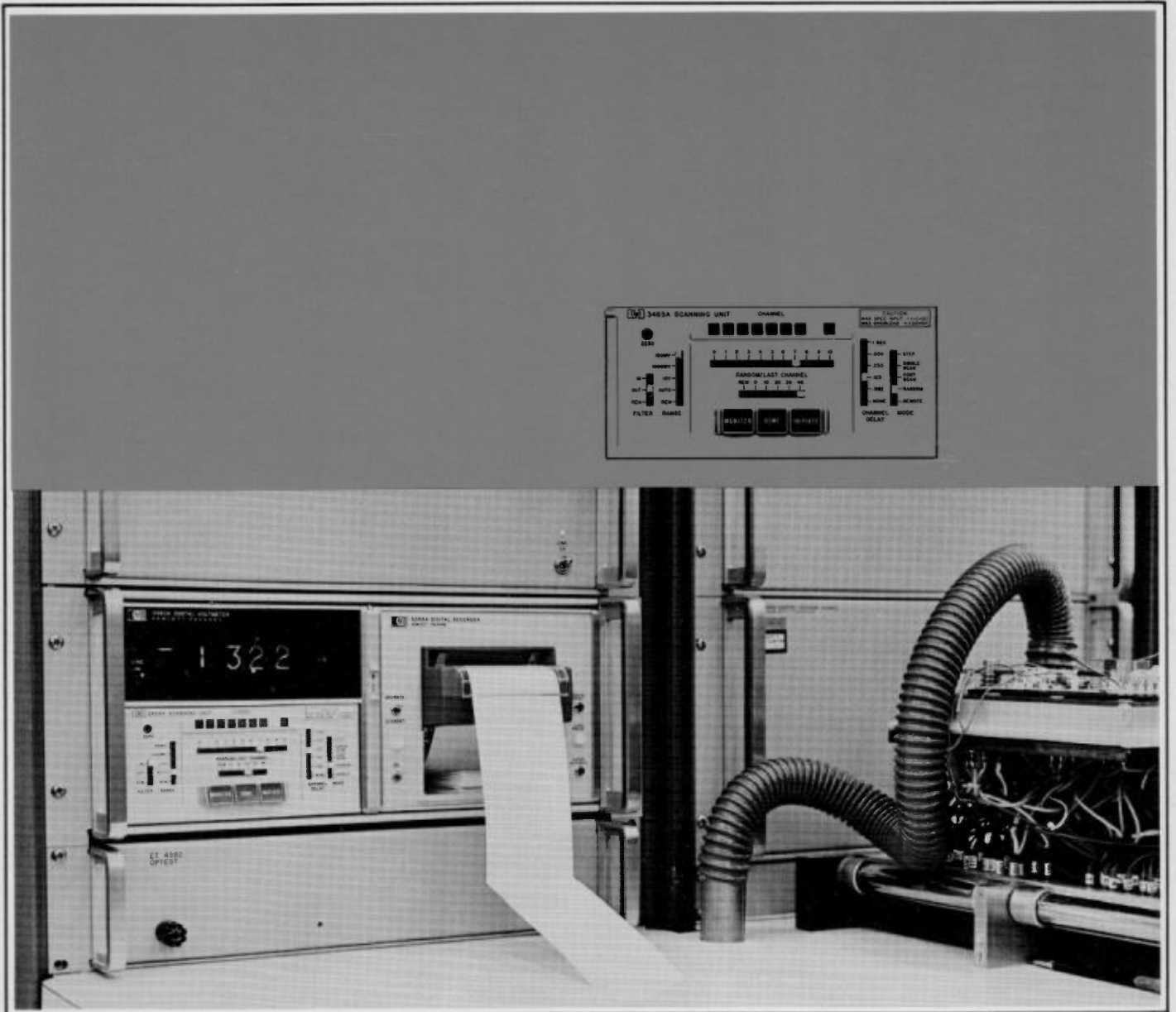


A GUIDE TO REMOTE CONTROL OF THE 3485A SCANNING UNIT

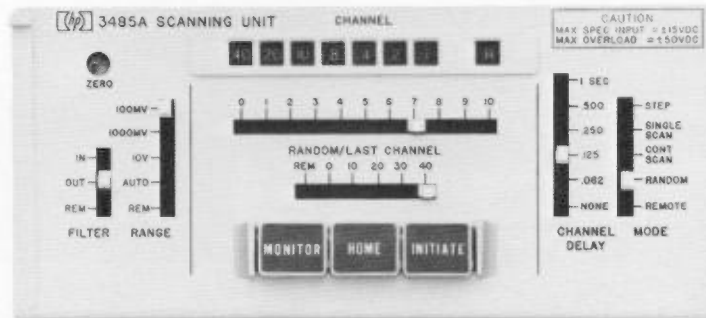


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A GUIDE TO REMOTE CONTROL OF THE 3485A SCANNING UNIT

This application note is designed to simplify remote operation of the 3485A Scanning Unit. Each remote control line is explained in full. Programming examples start with the simplest form of remote control and progress to complete control using all lines. When more than 50 channels are required, 3480/3485A combinations may be cascaded. The maximum scanning speed of the 3485A is 1000 channels/s and normally this speed would require the use of a computer. Data Storage, located within the 3480 mainframe, is able to store up to 50 complete readings at 1000/s for output on a printer at 10 lines/s. Accessories and connector diagrams conclude this application note.



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W108

Features

- Available in 10, 20, 30, 40 or 50 channel versions. Additional blocks of 10 channels may be added later to units with less than 50 channels.
- 3 dc ranges; 100 mV to 10 V full scale with autoranging.
- The reading on all channels is digitized with 4 digit resolution plus a 5th digit for up to 50% overranging.
- Input resistance $>10^9\Omega$.
- Scan rates up to 1000 channels/s; six selectable channel delays on the front panel (up to 1 s).
- Scan modes include single and continuous scan, step and random.
- All functions except the channel delay are remotely programmable.
- All remote input and output lines are isolated from the channel input to the scanner; floating measurements may be made when under control of a grounded system.
- Input switches are dual floating "J" FET switches.
- Each block of 10 channels has its own guard.
- There is a switchable 30dB (at 60 Hz) input filter.

NOTE:

Remote Control is purchased as Option 057 for the 3485A. The 3485A plugs into either a 3480A or 3480B mainframe. The mainframe must be equipped with Option 004 Isolated BCD or Option 005 Data Storage. The 3485A may also be used in a 2070A Data Logger and is purchased as Option 851 through 855 (depending on the number of channels). Isolated Remote is purchased as Option 857. The 2070A includes a 5055A Digital Recorder and a 3480A Option 004 DVM.

THE 3485A SCANNING UNIT

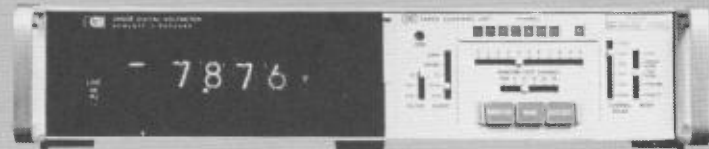


may be used with...

3480A MULTI-FUNCTION DVM



3480B MULTI-FUNCTION DVM



2070A DATA LOGGER

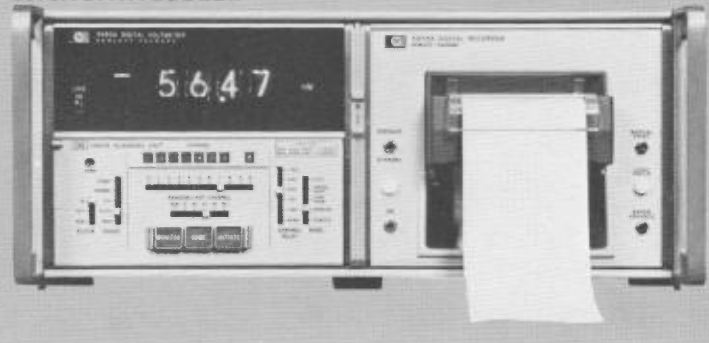


FIGURE 1

The 3485A Scanning Unit will plug into any of the above mainframes. The 3480A and 3480B are digital voltmeters. The 2070A is a digital voltmeter (3480A) internally wired to a 10 column digital recorder (5055A) to form a data logger in one package.

Specifications

CHANNELS

Number: up to 50 channels which may be purchased in increments of 10 channels.

Input configuration: floating FET switches with separate Guard for every block of 10 channels.

OPERATING MODES

Step: each channel is sequentially stepped manually or remotely.

Single scan: upon a manual or remote command, a single scan of every channel is made up to and including the last channel at the preselected Channel Delay rate.

Continuous scan: upon a manual or remote command, all channels up to and including the last channel are scanned continuously at the preselected Channel Delay rate.

Random: any randomly addressed channel may be selected manually or remotely.

RANGES

Ranges:

- ±100.00 mV
- ±1000.0 mV
- ±10.000 V

Range selection: manual, automatic, or remote.

Overrange: 50% on all ranges, ±50V max input.

Automatic ranging: upranges at 140% of range; downranges at 10% of range.

PERFORMANCE

Measuring speed

Response time

Filter Out: 1 ms to read within 1 count of final reading when triggered coincident with application of step input.

Filter In: 250 ms to read within 1 count of final reading.

Reading period (including response time and digitizing time): 950 μ s.

Scanning and reading rate

Manual: readings may be manually initiated on any one channel with a front panel self-latching pushbutton (Monitor) at a fixed 3 readings/second.

Internal: readings may be automatically initiated in the Single Scan or Continuous Scan modes at any one of six selected Channel Delays. Speed varies from 1 channel per second to 1000 channels per second. With Filter In, a minimum delay of 250 ms is used.

External: 0 to 1000 channels per second with external trigger.

Channel Delay: six delays; 1 s, 500 ms, 250 ms, 125 ms, 62 ms and "NONE". In "NONE", there is no dwell time on a given channel and the speed is limited mainly by the reading period (1 ms). The reading is taken after the selected Channel Delay.

Accuracy (90 days, 25°C, <95% RH)

100mV range: ±(0.01% of reading +0.04% of range).

100mV and 10V ranges: ±(0.01% of reading +0.01% of range).

Temperature coefficient

100mV range

Filter Out: ±(0.001% of reading +0.0005% of range)/°C.

Filter In: ±(0.001% of reading +0.0015% of range)/°C.

100mV and 10V ranges (with or without filtering): ±(0.001% of reading +0.0005% of range)/°C.

INPUT CHARACTERISTICS

Input resistance (25°C, <95%RH): $>10^7\Omega$.

Effective Common Mode Rejection (ECMR): ECMR is the ratio of the peak common-mode voltage to the resultant error in reading with 1k Ω unbalance in either lead.

DC: >80 dB.

AC (50–60 Hz)

Filter Out: >70 dB.

Filter In: >105 dB.

Normal Mode Rejection (NMR): NMR is the ratio of the peak normal mode signal to the resultant error in reading.

Filter Position	50 Hz	60 Hz and above
Out	0 dB	0 dB
In	>27 dB	>30 dB

Filter selection: manual or remote.

Noise: <30 μ V peak to peak.

Maximum operational voltage (for rated accuracy)

High to Low: ±15 V dc.

Guard to Chassis: ±50V peak.

Guard to Low: ±10V peak.

The algebraic sum of all voltages in a path between any Low to any High must not exceed ±15 V peak.

The maximum algebraic voltage difference between any Low to any other Low must not exceed ±15 V peak.

Maximum input voltage

Any High to any Low: ±50V.

Any Low to any other Low: ±50V.

Any Low to any Guard: +50V, -30V.

Any Guard to Chassis: ±50V.

Any Guard to any other Guard: ±50V.

Filter Out: >70 dB.

Channel-to-channel capacitance

Between channels within the same 10 channel block: ≤ 10 pF.

Between 10 channel blocks: ≤ 2.5 pF.

Crosstalk (with 1 k Ω source): 80 dB.

Specifications (continued)

ISOLATED REMOTE CONTROL OPTION 057

(can only be used with the 3480A/B
Option 004 and Option 005)

Note: remote controls are selected by application of a "Low" state (logical "0") through a rear panel connector. This option must be purchased to gain use of any of the following remote control lines.

State	Characteristics
"Low" (logical "0")	0 V to +0.5 V (2.5 mA max) or contact closure to ground through <math><200 \Omega</math>.
"High" (logical "1")	+2.4 V to +5 V or removal of contact closure to ground.

Program storage: allows entry and storage of the selected program eliminating the need for sustained "Low" on the selected control lines. Program is entered by application of a "Low" state to the Program Execute line. Program Acknowledge verifies receipt of program. Program Initiate executes a programmed sequence.

Remote control lines (see DEFINITION OF REMOTE CONTROL LINES, next section)

- Mode (4 lines)
- Range (2 lines)
- Filter (1 line)
- Random or Last Channel (7 lines)
- Program Execute (1 line)
- Program Initiate (1 line)
- Scan Inhibit (1 line)
- Printer Holdoff (1 line)
- Measure (Encode) (1 line)
- Internal Measure Inhibit (1 line)
- Home (1 line)

Output lines (from Isolated Remote Control Option 057)

State	Characteristics
"High" (logical "1")	+5 V, 6k Ω source resistance
"Low" (logical "0")	0 V to +0.5 V, 12 mA max sink current.

Output lines (see DEFINITION OF REMOTE CONTROL LINES, next section)

- Program Acknowledge (1 line)
- Flag (1 line)
- Ready (1 line)
- Not Ready (1 line)

Isolation characteristics: all control lines and output lines are referenced to earth ground (instrument chassis). Instrument will make floating measurements and maintain all Normal and Common Mode Rejection specifications. Pulse transformers isolate the remote control lines and output lines.

ISOLATED DIGITAL OUTPUT (3480A/B Option 004)

This option provides for the output of measurement data in digital form for printer and systems applications. In addition, input lines are included to remotely control the triggering of the 3480A/B.

Note: Isolated Digital Output is available only as a factory-installed option (3480A/B Option 004) and must be ordered at time of initial purchase if the mainframe is to be used with a 3485A equipped with Isolated Remote Control (3485A Option 057).

Isolation characteristics: output data lines and input control lines are referenced to earth ground (instrument chassis) and are well isolated from the measurement input terminals. Instrument will make floating measurements and maintain all Normal and Common Mode Rejection specifications when the data and control lines are utilized.

Flag (print command)

Print level: 0 V, 12mA max current sink.

Inhibit level: +5V or +10V, 6k Ω source resistance. (5V or 10V level selected with internal slide switch.)

BCD outputs

- 4 line BCD (1-2-4-8) "1" state positive, 9 columns of information:
- 5 columns for measurement magnitude.
- 2 columns for Channel I.D.
- 1 column for polarity and overload.
- 1 column for range.

BCD levels: output data is represented by a "High" state (logical "1") as defined below.

State	Output characteristics
"High" (logical "1")	+5 V, 6k Ω source resistance
"Low" (logical "0")	0 V to +0.5 V, 12 mA max sink current.

Note: output "High" and "Low" states will differ by at least 4 V if output load is 100 k Ω or greater.

BCD reference levels

Reference level	Output characteristics
Negative	0 V, 0 Ω source resistance.
Positive	+5 V \pm 10%, 6.8k Ω source resistance.

Storage: BCD output levels for previous reading are held until beginning of next measurement period.

Input lines

Printer Hold-off: application of "High" state (+6 V to +15 V) disables front-panel Sample Rate and Trigger controls.

Internal Measure Inhibit: application of "Low" state disables front-panel Sample Rate and Trigger controls.

DATA STORAGE (3480A/B Option 005)

This option allows the 3485A Scanning Unit to be used at its maximum scan rate in conjunction with a digital recorder. Up to 50 channels may be scanned and each reading stored at up to 1000 channels/s. Readings may be outputted from storage at a slower rate governed by a digital recorder or some other device. Refer to Data Storage Advance Information Sheet for more details.

GENERAL

Operating temperature: 0°C to 50°C.

Storage temperature: -40°C to +75°C.

Power: 115 V or 230 V $\pm 10\%$, 40 Hz to 440 Hz, 60 VA max (operating in a 3480A or 3480B mainframe).

Weights

3480A

basic instrument: 11 lb 12 oz (5,25 kg).
including options: 12 lb 8 oz (5,7 kg).
shipping: 17 lb (7,65 kg).

3480B

basic instrument: 12 lb 12 oz (5,71 kg).
including options: 13 lb 8 oz (6,15 kg).
shipping: 18 lb (8,1 kg).

3485A

basic instrument: 5 lb 14 oz (2,6 kg).
including all options: 7 lb 3 oz (3,2 kg).
shipping: 8 lb 14 oz (4 kg).

Accessories furnished with:

Option 057

Isolated Remote cable 6 ft long with connector.

Option 051 through 055

Channel board connector (for 10 channels), one furnished with each channel board.

Accessories available

HP 11166A: 10 channel board including mating connector. May be used to increase the number of channels in a 3485A up to 50. This board is field installable.

HP 11167A: channel input cable 12 ft long shielded (shield connected to Guard) with 10 twisted pairs.

HP 11168A: Isolated Remote Control (same as 3485A Option 057). This option requires the 3480A/B be equipped with Option 004 Isolated BCD or Option 005 Data Storage.

HP 11169A: Isolated Remote cable 6 ft long with connector (furnished as part of 3485A Option 057).

HP 3485A Scanning Unit (equipped with no channels) Fits either 3480A (1/2 module) or 3480B (full rack width) mainframes.

Requires one of the following options:

- Option 051 10 channels
- Option 052 20 channels
- Option 053 30 channels
- Option 054 40 channels
- Option 055 50 channels

Remote Control

Option 057 Isolated Remote Control. Must be used with a 3480A or 3480B mainframe equipped with Option 004 Isolated BCD or Option 005 Data Storage/Isolated BCD.

Note: the HP 3485A will not work with mainframe Option 003, Non-isolated BCD.

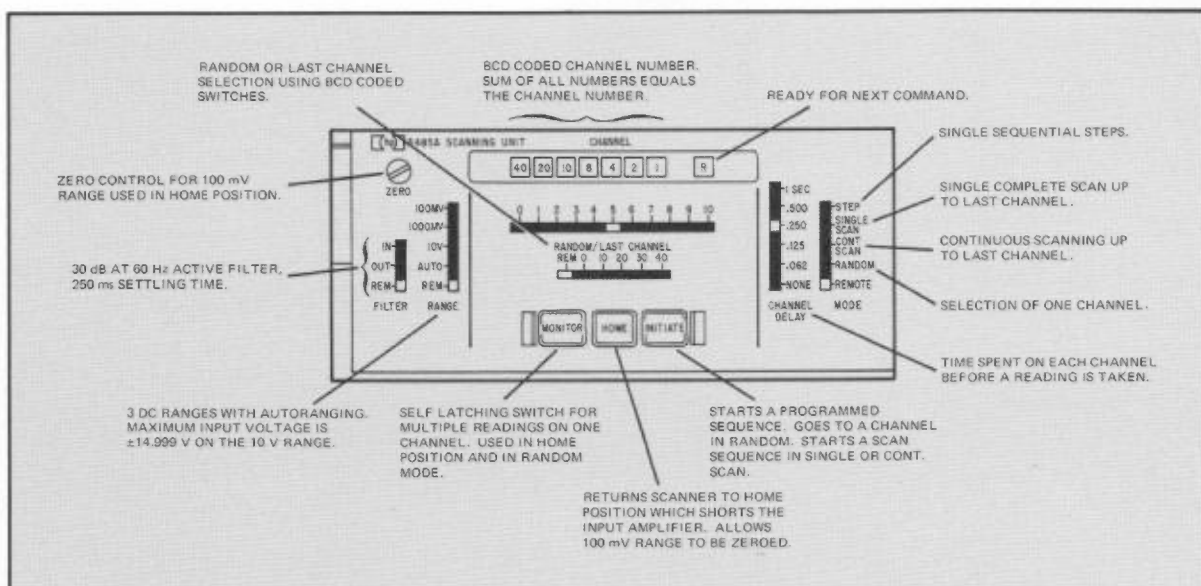


FIGURE 2
A front panel guide to the 3485A Scanning Unit.

Definition of Remote Control Lines

PROGRAM LINES

Selection of Mode (4 lines)

STEP. Each PROGRAM INITIATE steps the scanner sequentially from Channel 1 through LAST CHANNEL at up to 1000 channels/s (or manually at 2 channels/s). When the LAST CHANNEL is reached, the next PROGRAM INITIATE steps the Scanner back to Channel 1 to begin over. The time spent on each channel is determined by one of six dwell times selected on the front panel CHANNEL DELAY switch (from 1 s to "NONE"). Scanning speed is determined by the interval between PROGRAM INITIATE commands and CHANNEL DELAY setting.

SINGLE SCAN. PROGRAM INITIATE starts an automatic scan of all channels from Channel 1 through the LAST CHANNEL at up to 1000 channels/s. Six dwell times may be selected on the front panel CHANNEL DELAY switches from 1 s to "NONE".

CONTINUOUS SCAN. A PROGRAM INITIATE starts repeated scans of all channels from Channel 1 through the LAST CHANNEL at up to 1000 channels/s. Six dwell times may be selected on the front panel CHANNEL DELAY switch from 1 s to "NONE". Scanning may be stopped using RESET or the front panel HOME button.

RANDOM. A PROGRAM INITIATE causes an individually addressed channel to be scanned and read. Channels may be addressed using the RANDOM CHANNEL lines or by front panel switches. The reading may be taken on the randomly addressed channel after one of six dwell times using the front panel CHANNEL DELAY switch. The Scanner will remain on the randomly selected channel until RESET is issued or another channel is addressed.

Selection of Range (2 lines)

100mV RANGE. Selected by leaving both lines open.

1000mV RANGE. 1000mV line is grounded.

10V RANGE. 10V line is grounded.

AUTORANGE. Selected manually on the front panel using the "AUTO" position. Upranging is at 140% of full scale and downranging is at 10% of full scale. Range information is transmitted as part of the BCD output.

Selection of Filter (1 line)

FILTER OUT. Line left open (high).

FILTER IN. Line grounded.

With the FILTER IN, the CHANNEL DELAY automatically becomes 250 ms or greater. All settings below 250 ms are ignored to allow for settling time.

Reset (1 line)

When RESET is given, the Scanner stops any activity (such as CONTINUOUS SCAN) and goes to a HOME position. In the HOME position, all channels are disconnected and the Input Amplifier is shorted. Any zero offset may be recorded or taken out using the front panel ZERO control and MONITOR (for triggering at 3 readings/s).

CONTROL LINES

Program Execute

Application of low state for $>50 \mu\text{s}$ causes a program to be entered into program storage (within the remote control unit). This line must remain high at least 1.5 ms before another low state may be applied.

Program Initiate

Application of low state for $>25 \mu\text{s}$ causes any program held in program storage to be executed.

Scan Inhibit

Application of low state within $10 \mu\text{s}$ after FLAG goes low will prevent the Scanner from automatically advancing in the SINGLE SCAN or CONTINUOUS SCAN modes and give the system time to acquire the BCD data. Scanning continues automatically when this line is released (high state).

Printer Hold-off

Same as SCAN INHIBIT only the logic sense is reversed. This line is used mainly for HP digital recorders.

Measure

Application of low state for $>25 \mu\text{s}$ causes the 3480 to take one reading (i.e., starts the 3480's $950 \mu\text{s}$ reading period). MEASURE is used in either the STEP or RANDOM modes for external triggering.

Internal Measure Inhibit

Application of low state inhibits internal triggers and is normally used when MEASURE is used. Do not use this line in the SINGLE SCAN or CONTINUOUS SCAN modes. This line may be used to skip the measurement of a given channel in the STEP mode if low state is applied coincident with PROGRAM INITIATE.

OUTPUT LINES

Program Acknowledge

Line goes high when PROGRAM EXECUTE is issued and remains high for 2.2 ms until programs have been entered in storage. Line then goes low indicating that the Scanner is ready to accept a PROGRAM INITIATE.

Flag

Line goes high at the beginning of a reading period (coincident with internal or external trigger) and falls low $950 \mu\text{s}$ later indicating that the BCD data is ready to be accepted.

Ready

Line goes low to indicate that a programmed scanning sequence is in progress. This line goes high $25 \mu\text{s}$ before the last FLAG on the last channel goes low. This tells the system that the Scanner has finished a programmed sequence and that it is ready for the next set of commands.

Preprogrammed Operation

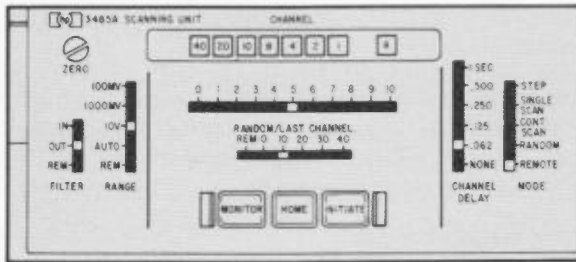


FIGURE 3

Front panel switch settings for preprogrammed operation. In this case, a single scan of 15 channels will be made on the 10V range, no filter with a 62ms dwell on each channel. A PROGRAM EXECUTE will start the scanning sequence.

- All functions except MODE are set up manually on the 3485A's front panel. Refer to Figure 3 for an example. These manually selected functions include:
 1. CHANNEL DELAY (in 6 steps from "NONE" to 1 s)
 2. RANDOM/LAST CHANNEL
 3. RANGE (100 mV, 1000 mV, 10 V or AUTO)
 4. FILTER
- The desired mode of operation is hard-wired in. PROGRAM ACKNOWLEDGE is wired to PROGRAM INITIATE to eliminate a separate initiate line. PROGRAM EXECUTE will strobe the information into remote control and after a 2.2ms delay, will start the scan sequence automatically. Refer to Figure 4 for timing.
- When the first reading is ready to be recorded, FLAG will drop low. If the Scanner is in the SINGLE SCAN or CONTINUOUS SCAN modes, SCAN INHIBIT is required to keep the Scanner from automatically advancing to the next channel and to allow time to acquire the data.
- PRINTER HOLDOFF is used primarily with digital recorders and does exactly the same thing as SCAN INHIBIT.
- The READY signal indicates the end of a scan sequence. This line goes high 25 μ s prior to the last FLAG on the last channel going low. READY tells the system when the next PROGRAM EXECUTE can be given to start the next scan sequence.
- Preprogrammed operation requires the system to issue:
 1. PROGRAM EXECUTE to begin a scan sequence.
 2. SCAN INHIBIT to allow time for the system to acquire the data on each channel (required only for SINGLE SCAN or CONTINUOUS SCAN modes).
- The system must recognize:
 1. FLAG to tell when each reading is ready to be recorded.
 2. READY to tell when a scan sequence is complete.
- The user must hard wire:
 1. The desired mode (STEP, SINGLE SCAN, etc.)
 2. PROGRAM ACKNOWLEDGE to PROGRAM INITIATE
- Flexibility lost using preprogrammed operation:
 1. The scan mode is fixed (hard wired).
 2. The same delay is used on each channel.
 3. The ending address is fixed on the front panel.
 4. A fixed range is used (except in AUTO).
 5. A fixed filter position is used.

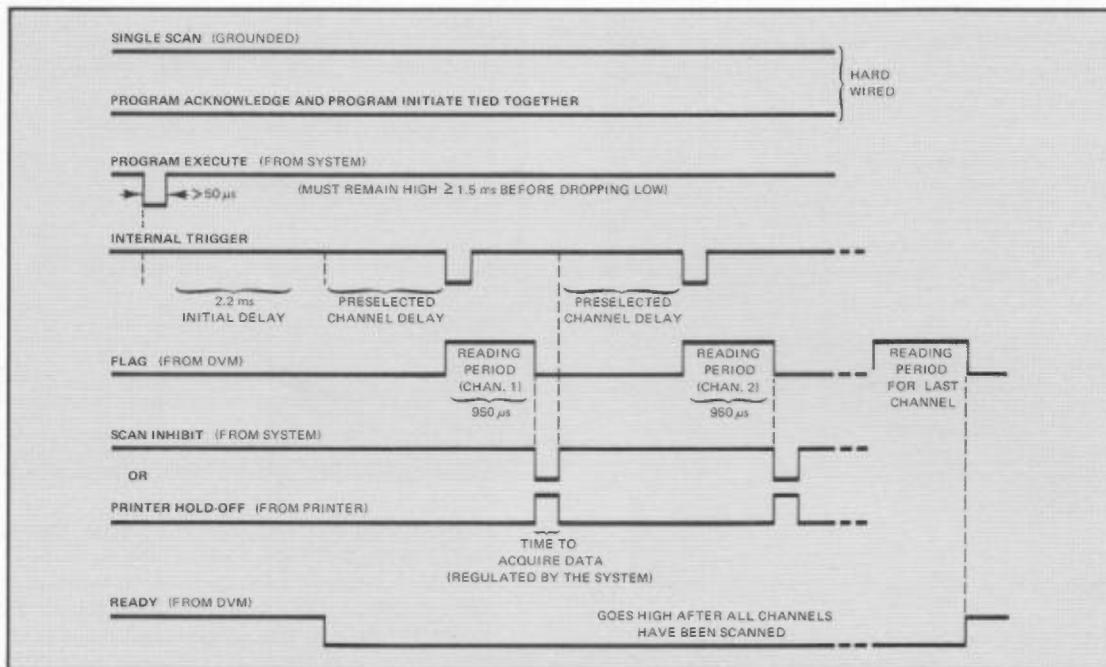


FIGURE 4

Preprogrammed operation of the 3485A where PROGRAM EXECUTE starts an automatic scanning sequence. CHANNEL DELAY, RANDOM/LAST CHANNEL, RANGE and FILTER are set-up manually on the front panel (see Figure 3 for an example). READY indicates the completion of a scanning sequence. The first reading on Channel 1 will require an additional 2.2 ms to automatically enter the program into storage within the remote control unit. SCAN INHIBIT and PRINTER HOLD-OFF both stop the scanner from automatically advancing to the next channel and allow time for the system to absorb the data (SINGLE SCAN or CONTINUOUS SCAN modes).

Remote Control Using Internal Triggering

- The Scanner is allowed to trigger itself after a preprogrammed CHANNEL DELAY setup on the front panel. All other remote control lines are used. Refer to Figure 5 for front panel switch settings.
- PROGRAM EXECUTE strobes a set of program instructions into the remote control storage register. PROGRAM ACKNOWLEDGE indicates when programming is complete and when the Scanner is ready to begin a scan sequence. Refer to Figure 6 for an example.

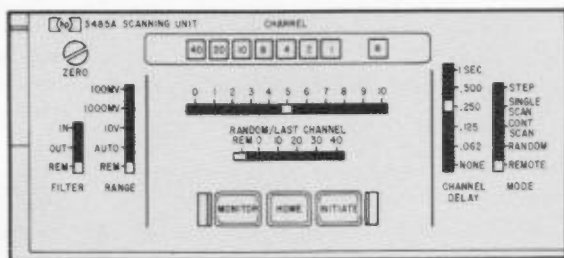


FIGURE 5

Front panel switch settings for remote control using internal triggering. All switches except CHANNEL DELAY are put in the "REMOTE" or "REM" position. The appropriate CHANNEL DELAY is selected such as 250 ms as shown above. Each channel will have a 250 ms dwell time before digitizing begins.

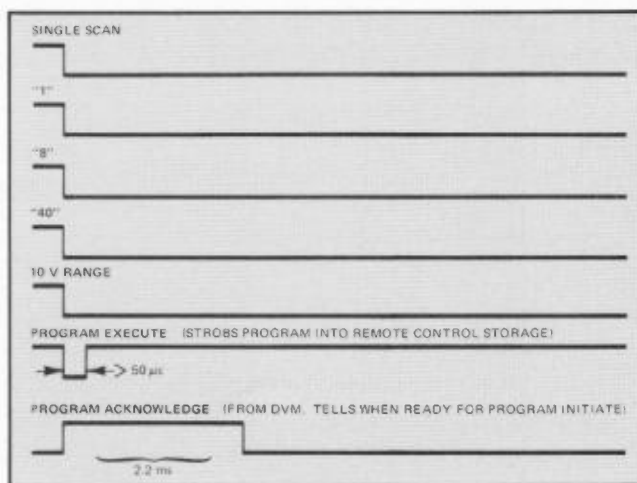


FIGURE 6

Programming example where a single scan of Channels 1 through 49 are to be made on the 10V range. The dwell time on each channel is selected manually using CHANNEL DELAY on the front panel. PROGRAM EXECUTE strobes the programmed sequence into remote control storage. PROGRAM INITIATE may be given after PROGRAM ACKNOWLEDGE fall low. If the same program is to be used again, a second PROGRAM INITIATE may be given thus avoiding reprogramming.

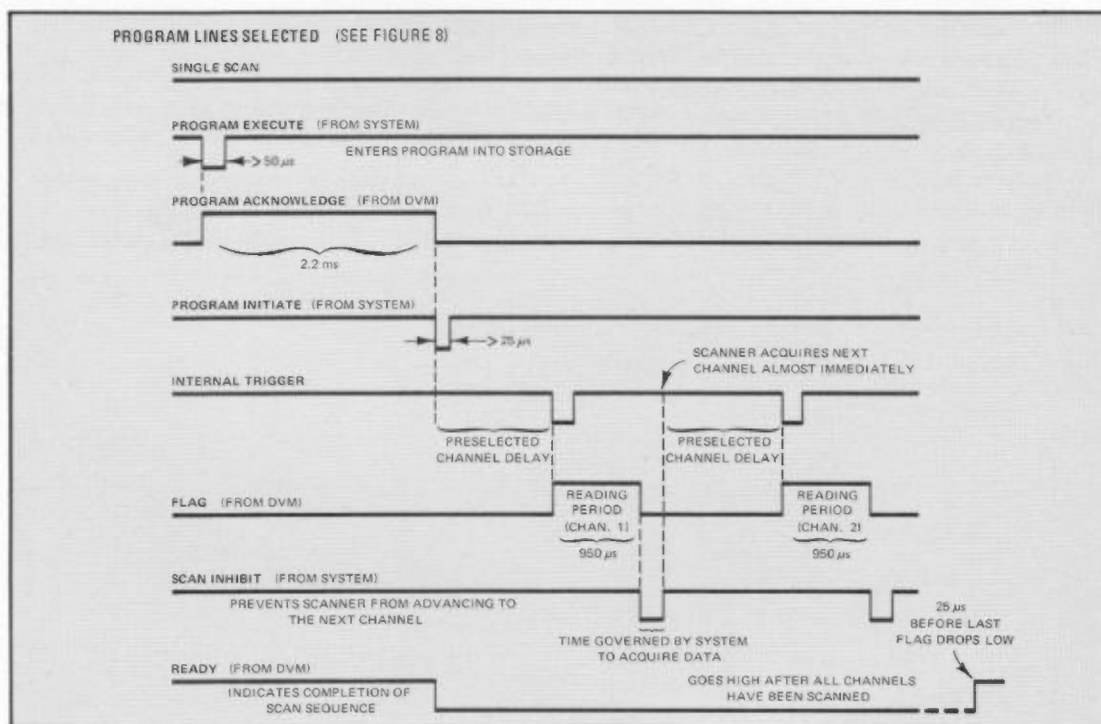


FIGURE 7

Remote control of 3485A using internal triggering and a preselected CHANNEL DELAY on the front panel. The SINGLE SCAN mode is selected along with the LAST CHANNEL (lines not shown). PROGRAM INITIATE starts the scan sequence. READY indicates completion of the sequence. This scan sequence may be repeated without reprogramming by issuing PROGRAM INITIATE. SCAN INHIBIT is necessary to keep Scanner from automatically advancing while system is taking data in. Refer to Figure 9 for detail on the timing for SCAN INHIBIT.

- PROGRAM INITIATE starts the scan sequence. READY indicates when a sequence has been completed. Figure 7 gives an example in the SINGLE SCAN mode and Figure 8 shows operation in the RANDOM mode.
- A second PROGRAM INITIATE may be issued to carry out the same sequence a second time without re-programming. This eliminates the need to issue PROGRAM EXECUTE then wait 2.2 ms for PROGRAM ACKNOWLEDGE.
- PROGRAM EXECUTE may be issued simultaneous to grounding the program lines. PROGRAM ACKNOWLEDGE may be hard wired to PROGRAM INITIATE. This makes the Scanner "self initiating" such that PROGRAM EXECUTE will start the scanning sequence.

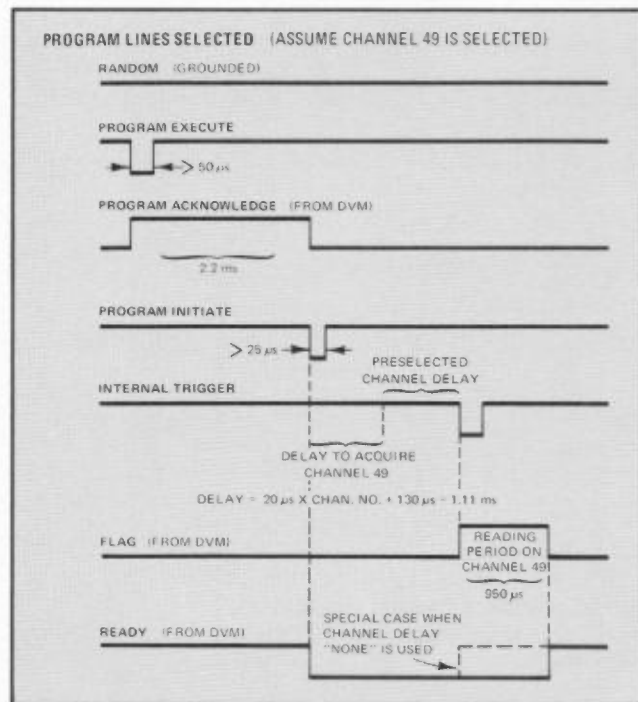


FIGURE 8

Remote control in the RANDOM mode where Channel 49 is addressed. One reading is taken after the preselected CHANNEL DELAY. After FLAG goes low or READY goes high, the next channel to be randomly addressed may be programmed using PROGRAM EXECUTE. Successive readings may be taken on a given channel using external triggering or by issuing a second PROGRAM INITIATE (reading made after CHANNEL DELAY).

Note: When CHANNEL DELAY is in "NONE", READY goes high when Flag goes high (instead of when Flag goes low). In the RANDOM MODE, PROGRAM INITIATE should be keyed from FLAG instead of READY.

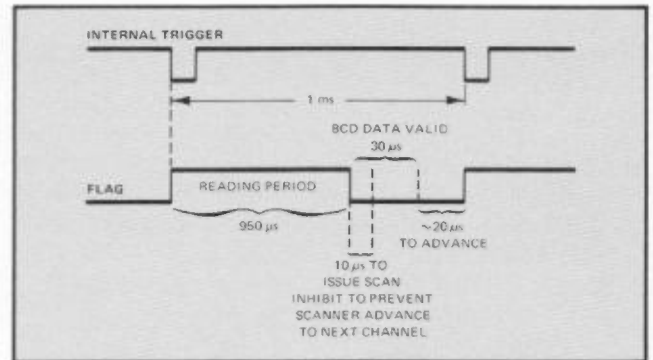


FIGURE 9

Internal triggering in the SINGLE SCAN or CONTINUOUS SCAN mode with CHANNEL DELAY in the "NONE" position. After the FLAG goes low, the system has 10 μs to return with a SCAN INHIBIT to prevent the Scanner from automatically advancing to the next channel. The Scanner will otherwise free run at 1000 channels/s allowing 30 μs for valid BCD data on each channel. Data storage may be ordered with the 3480A or B mainframe to allow operation at this speed by storing each reading for later output at a slower speed (i.e., on a digital recorder at 10 lines/s).

- Special case: In the SINGLE SCAN or CONTINUOUS SCAN modes and if CHANNEL DELAY is put in the "NONE" position, SCAN INHIBIT may be used for the desired channel spacing. When SCAN INHIBIT is released (ungrounded), the Scanner will immediately advance to the next channel and take a reading in 950 μs. This does not allow any dwell time for the input signal to settle, however. In this mode, SCAN INHIBIT must be issued within 10 μs after the FLAG goes low as shown in Figure 9. The BCD reading is valid for 30 μs.
- The system must issue:
 1. MODE (4 lines)
 2. RANDOM/LAST CHANNEL (7 lines)
 3. RANGE (2 lines)
 4. FILTER (1 line)
 5. PROGRAM EXECUTE (enters program into storage)
 6. PROGRAM INITIATE (to begin a scan sequence)
 7. SCAN INHIBIT (to allow time to absorb the data on each reading)
- The system must recognize:
 1. PROGRAM ACKNOWLEDGE (tells when program has properly entered storage)
 2. FLAG (tells when reading is ready to be recorded)
 3. READY (tells when scan sequence is complete)
- Flexibility lost by using remote control with internal triggering: the same delay is used on each channel.

Complete Remote Control

- All remote control lines are used including MEASURE to externally trigger the Scanner. The system may supply its own delay on each channel. This type of operation is restricted to the STEP and RANDOM modes.
- Complete remote control is used only when (1) different channel delays are needed on each channel, or (2) where a specific delay not covered in the six CHANNEL DELAY positions is needed or (3) where the Scanner is to be completely under system control.
- All front panel switches are put in the "REM" or "REMOTE" position and CHANNEL DELAY is put in the "NONE" position.
- INTERNAL MEASURE INHIBIT is grounded to insure that all internal triggers are inhibited.
- Figure 10 gives an example in the STEP mode and Figure 11 shows operation in the RANDOM mode.
- The system must issue:
 1. MODE (2 lines, RANDOM or STEP)
 2. RANDOM/LAST CHANNEL (7 lines)
 3. RANGE (2 lines)
 4. FILTER (1 line)
 5. PROGRAM EXECUTE (1 line)
 6. PROGRAM INITIATE (1 line)
 7. MEASURE (1 line)
 8. INTERNAL MEASURE INHIBIT (1 line wired to ground)
- The system must recognize:
 1. PROGRAM ACKNOWLEDGE
 2. FLAG
 3. READY

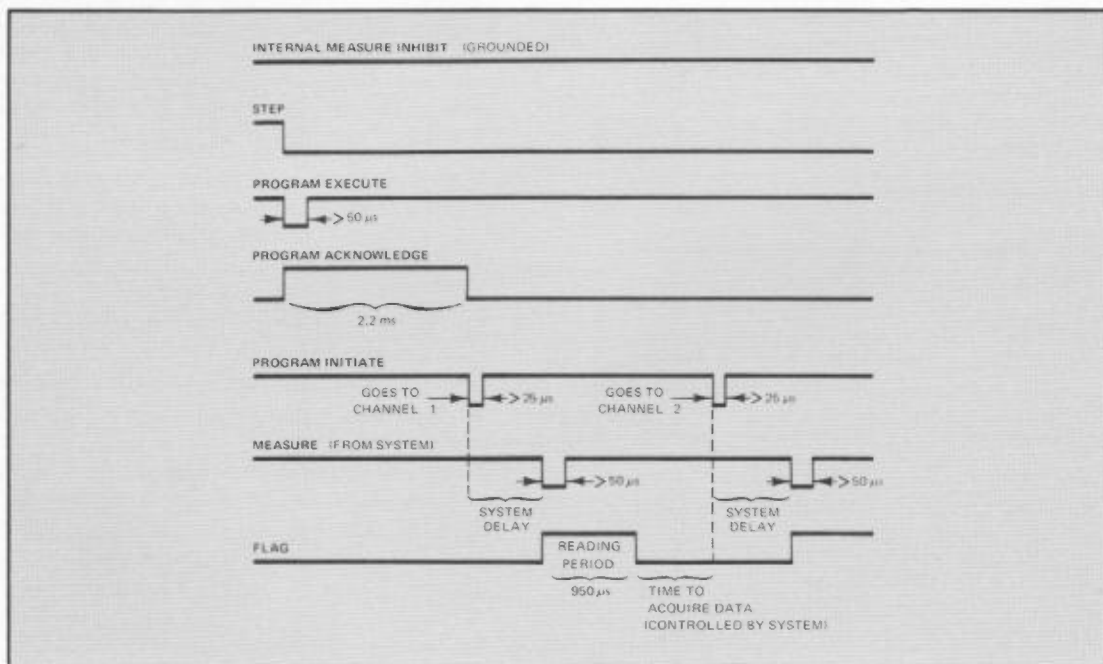


FIGURE 10

Complete remote control in the STEP mode using external triggering (MEASURE). SCAN INHIBIT is not needed since the system itself originates triggering. INTERNAL MEASURE INHIBIT is grounded to prevent internal triggering.

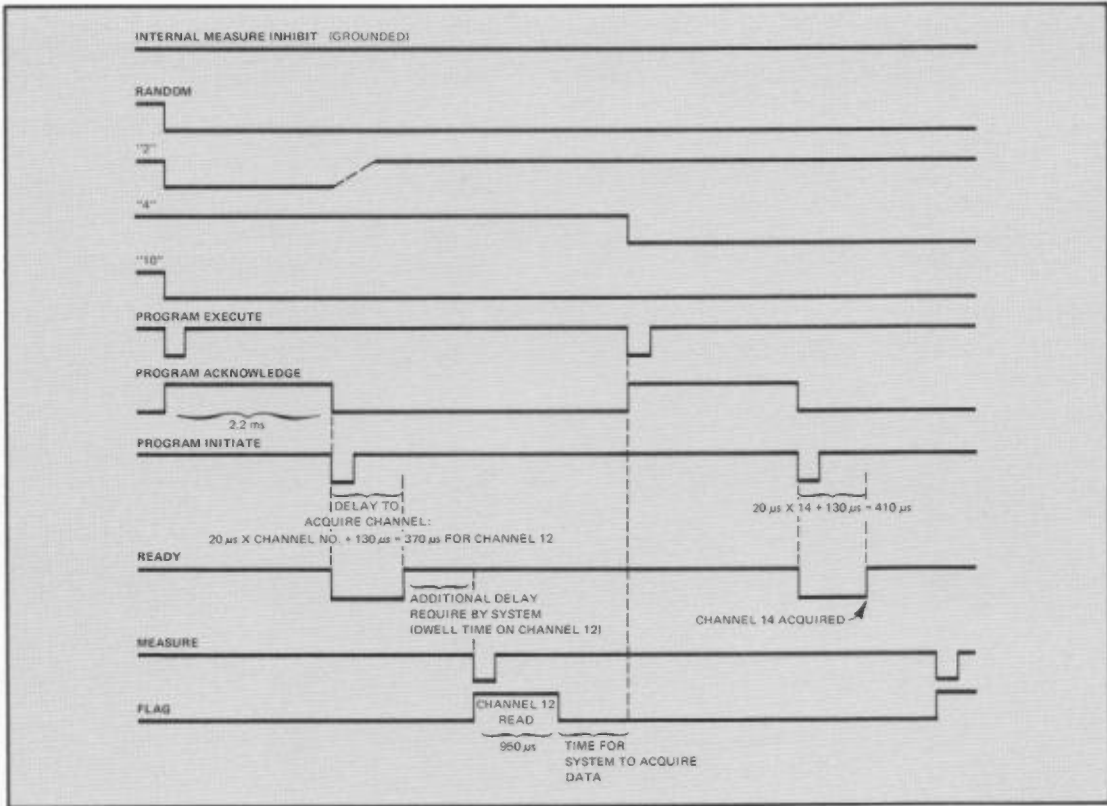


FIGURE 11

Complete remote control in the RANDOM mode using external triggering (MEASURE). Channel 12 is addressed, acquired, and read after a system controlled delay. Channel 14 is then addressed, acquired, and read. The dwell time on a given channel is equal to the time READY goes high and MEASURE is issued by the system. The difference between PROGRAM INITIATE and MEASURE includes the delay required to acquire the channel plus the dwell time on a given channel.

Cascaded Operation

- Some users will need to scan more than 50 channels (the capacity of 3480/3485A combination). This may be done by cascading units together as shown in Figure 12.
- The system will begin scanning with a PROGRAM INITIATE issued to Scanner #1. When Scanner #1 completes its scan, control is automatically transferred to Scanner #2. Cascading may be continued indefinitely. See Figure 13 for the timing.
- The system must recognize when the READY line on the last Scanner goes high indicating that the very last channel has been scanned and read.
- The transfer of control takes 2.2 ms between Scanners because of the delay in transmitting PROGRAM ACKNOWLEDGE.
- Multiple BCD inputs are required to gather data, one for each 3480/3485A combination.

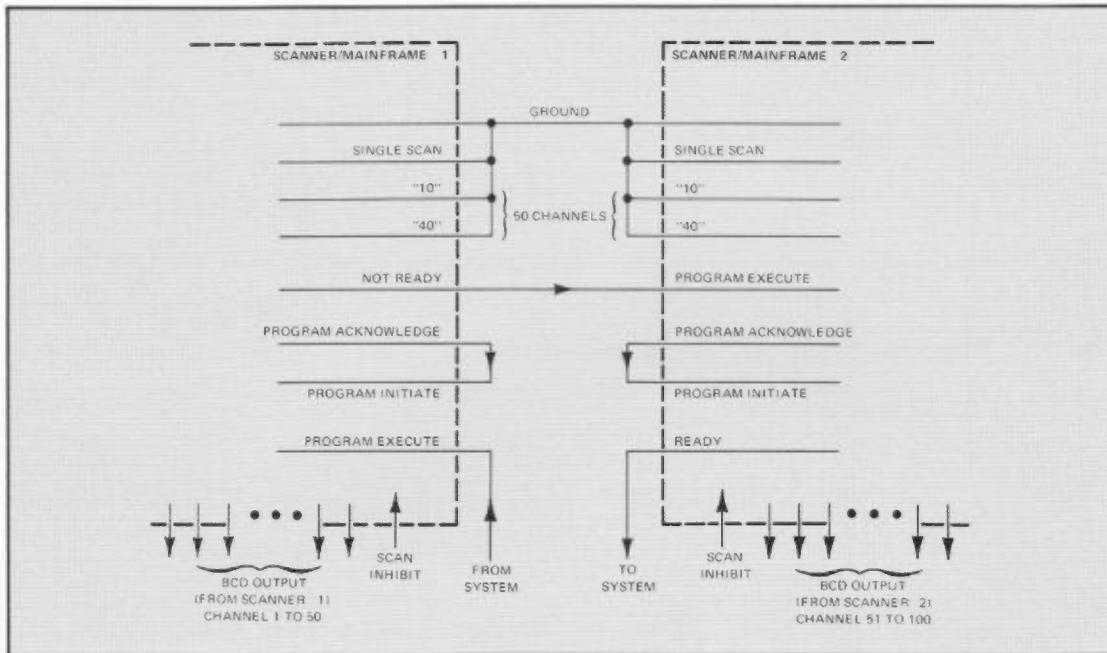


FIGURE 12

Interconnections required to slave two Scanners together to scan 100 channels. The system issues a PROGRAM EXECUTE to start the scanning. The NOT READY transfers control mid-way to Scanner #2. The READY from Scanner #2 indicates completion of the scanning sequence. Each Scanner/mainframe combination has its own BCD output which must be sampled by the system.

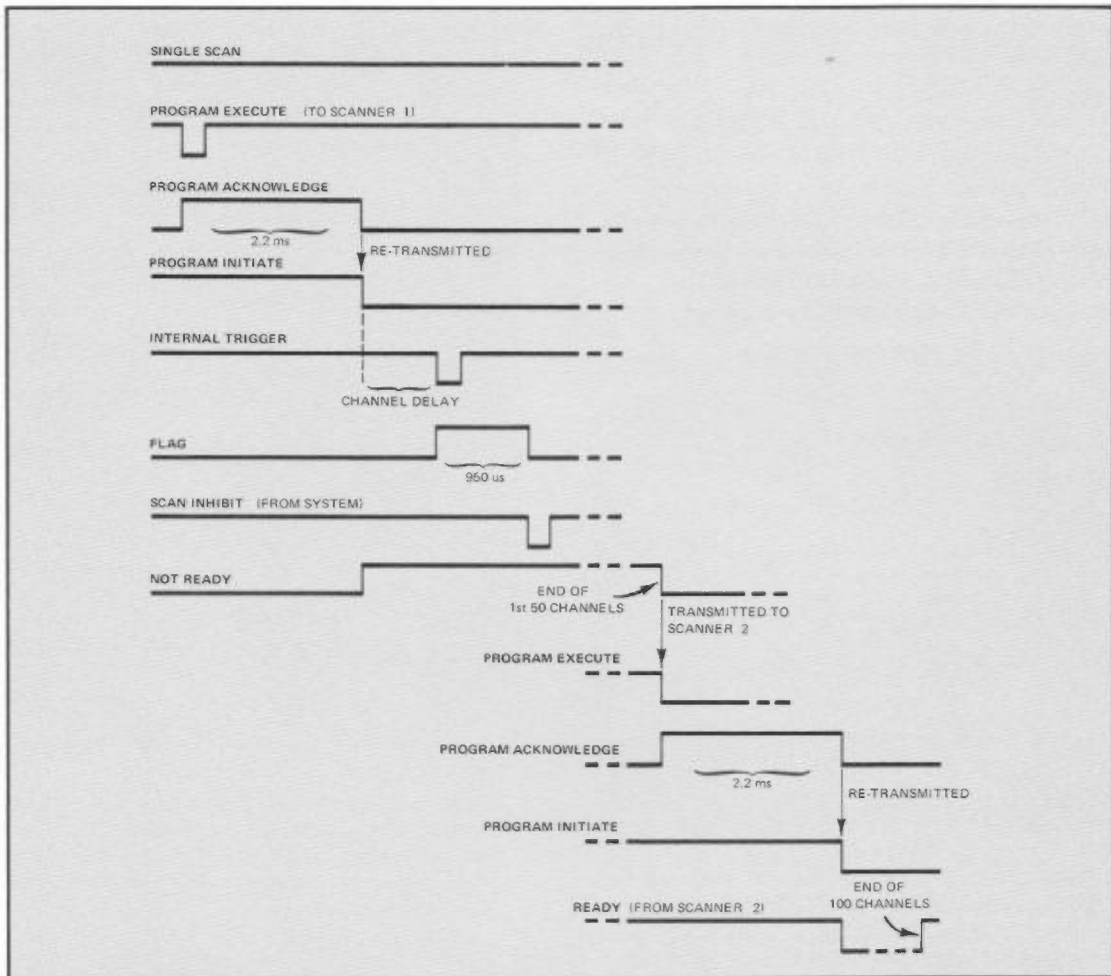


FIGURE 13
 Timing for cascading two scanners to scan 100 channels (see Figure 12 for interconnections).

Improving Programming Speed

- PROGRAM INITIATE may be issued 150 μs after PROGRAM EXECUTE without waiting for PROGRAM ACKNOWLEDGE to drop low. Exception: when FILTER "IN" was used and is being switched "OUT" or in the RANDOM mode. Refer to Figure 14 for an example.
- In the RANDOM mode, MEASURE may be issued after PROGRAM INITIATE according to the following rule:
 DELAY AFTER PROGRAM INITIATE:
 $20 \mu\text{s} \times \text{CHANNEL NUMBER} + 130 \mu\text{s}$
 Refer to Figure 15 for a specific example.

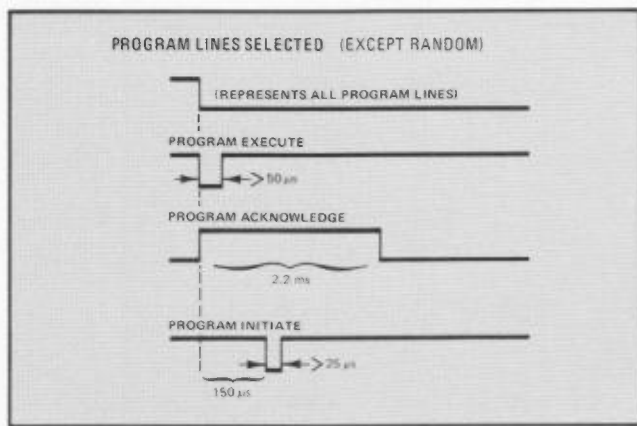


FIGURE 14

Improved programming speed by issuing PROGRAM INITIATE 150 μs after PROGRAM EXECUTE and not waiting for PROGRAM ACKNOWLEDGE. This improvement does not apply where the FILTER was "IN" and is to be "OUT" or in the RANDOM mode.

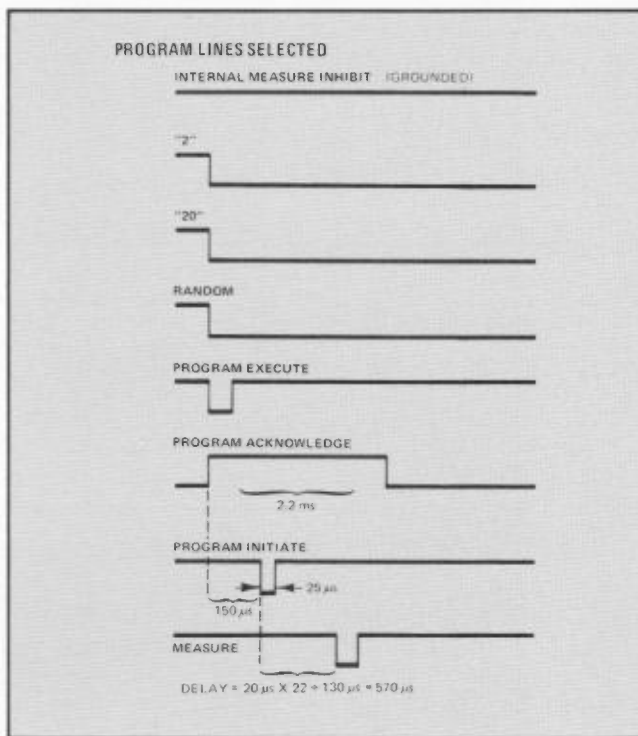


FIGURE 15

Improved programming speed in the RANDOM mode for addressing and reading Channel 22. The minimum separation between PROGRAM INITIATE and MEASURE is governed by the above delay which is a function of the channel number.

Improving Scanning Speed Using Data Storage

- The 3485A Scanning Unit is able to run at up to 1000 channels/s but this speed is usable only with a device capable of accepting information at this rate, i.e., a computer based system.
- To overcome this disadvantage and to allow a relatively low-cost digital recorder to be used with a 3485A running at high speed, Data Storage (mainframe option 005) is available. Data Storage has the following characteristics:
 1. Ability to store 10, 20, 30, 40 or 50 complete readings (selectable using 4 STORAGE LIMIT control lines).
 2. Ability to input at up to 1000 readings/s.
 3. Ability to output at very slow speeds up to a maximum rate of 50,000 readings/s.
 4. Fits in a 3480A 1/2 module mainframe, a 3480B full rack mainframe or a 2070A Data Logger.
 5. Information stored includes 4-digit reading plus 5th overrange digit, 2-digit storage I.D., tens channel I.D., polarity, overload and range.
 6. Information may be gated out using PRINTER HOLD-OFF (positive going) or DUMP HOLD (negative going) signals. See Figure 16 for timing.
- When Data Storage is used with a printer, operation is automatic. PROGRAM INITIATE starts the scanning sequence. When scanning is complete, STORAGE FLAG goes low indicating that the 1st reading (taken on Channel 1) is ready. PRINTER HOLD-OFF from the digital recorder is used to gate readings out of storage.

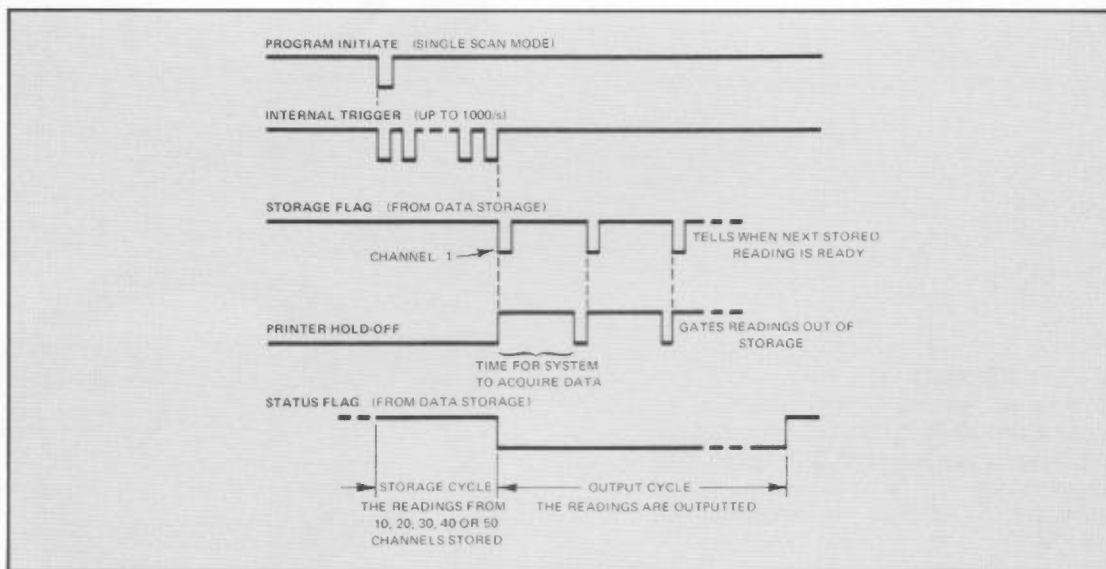


FIGURE 16
Using Data Storage allows up to 50 complete readings to be stored in the DVM at 1000/s for output later at a speed determined by an external device (such as a printer at 10 lines/s).

Accessories

FIGURE 17

HP 11166A 10 channel board including mating connector. This accessory may be field installed to increase the number of channels in a 3485A up to 50.

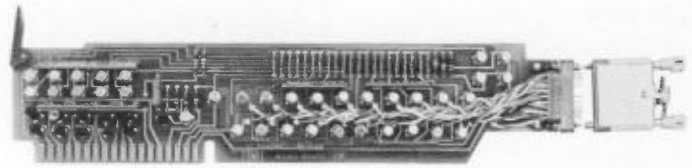


FIGURE 18

HP 11167A channel input cable 12 ft long with shield connected to guard and 10 twisted pairs.



FIGURE 19

HP 11168A Isolated Remote Control (identical to Option 057) which may be field installed but only used in 3480A or B mainframes equipped with Option 004 Isolated BCD or Option 005 Data Storage or in any 2070A Data Logger (all 2070A's are equipped with 3480A Option 004's).

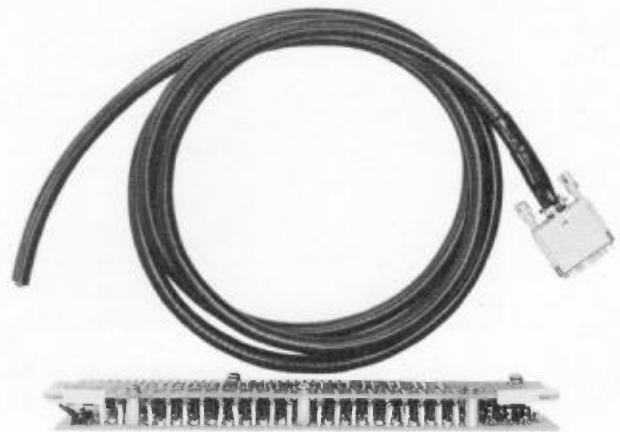


FIGURE 20

HP 11169A Isolated Remote cable 6 ft long with connector. This cable is furnished as part of Option 057 or part of HP 11168A Isolated Remote Control. It is offered separately for those needing more than one cable.



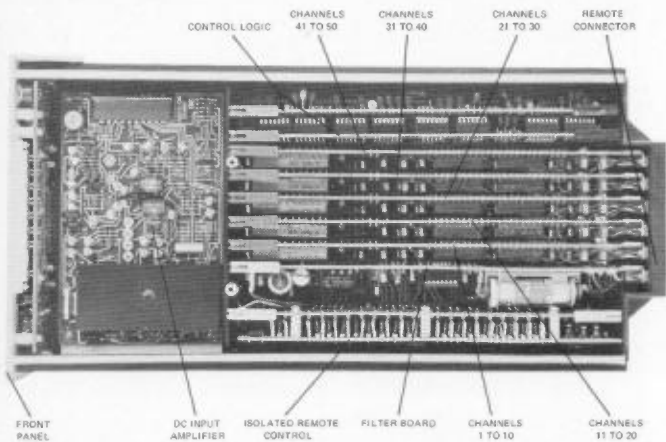


FIGURE 21
Top view of the 3485A Scanning Unit with the cover off. The location of the major functional areas are shown. Inter-connections are made through a "mother board".

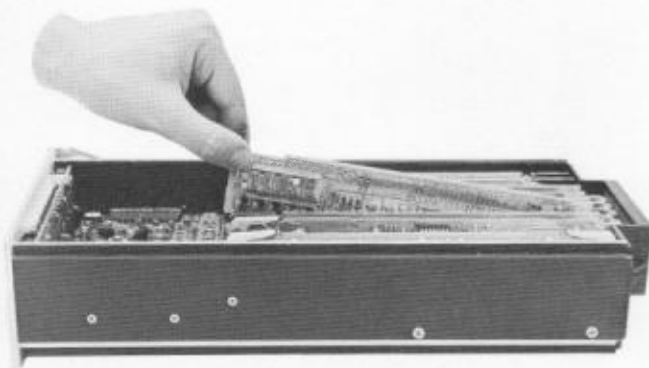


FIGURE 22
The channel boards in the 3485A are easy to remove or install.

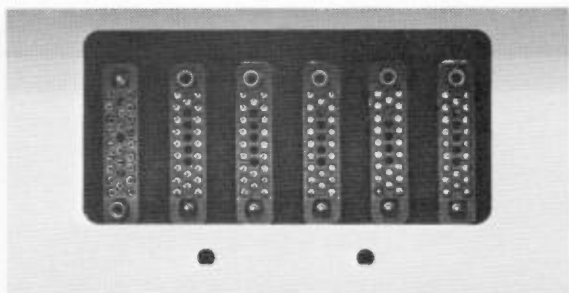


FIGURE 23
The channel input connectors protrude through the rear panel of the 3480 mainframe. The female connector on the left is for the Isolated Remote Control unit.

Connector Diagrams

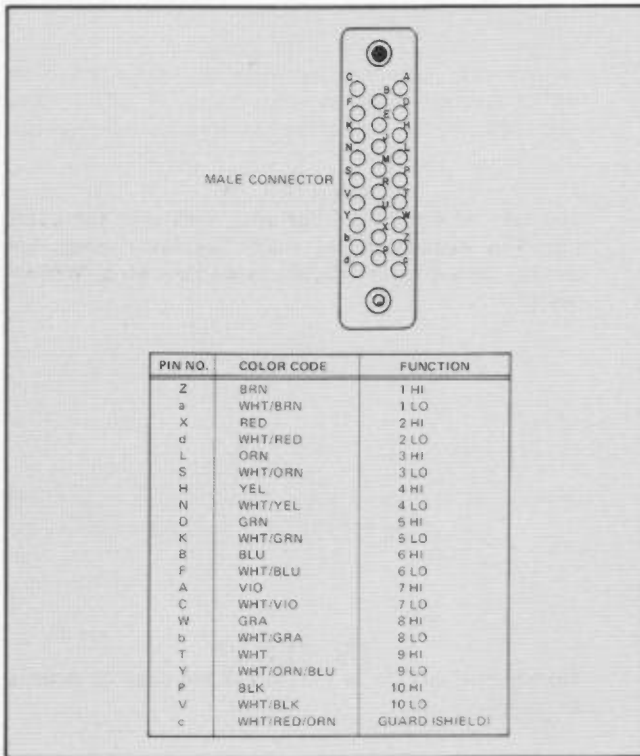


FIGURE 24

Pin number, color code and function for the HP 11167A channel input cable.

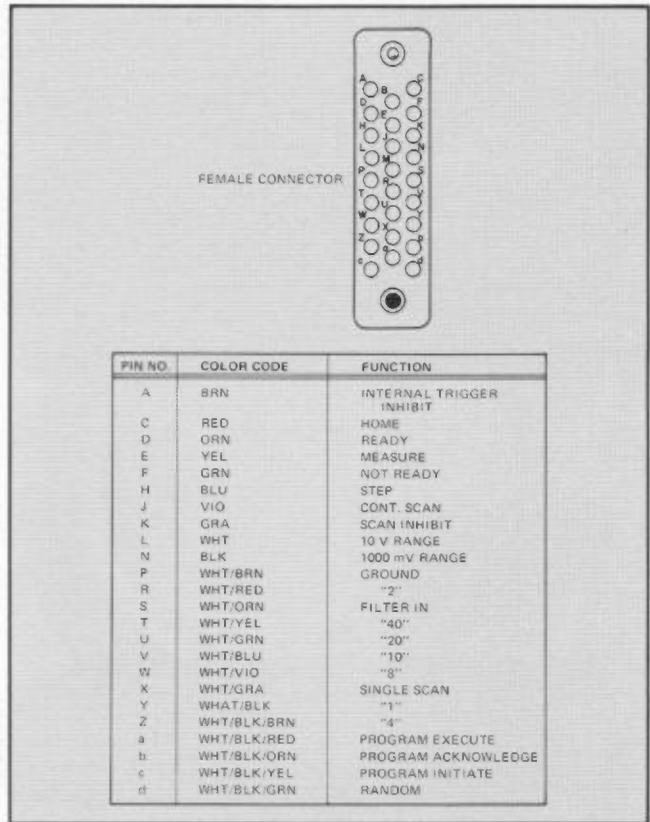


FIGURE 25

Pin number, color code and function for the HP 11169A Isolated Remote Cable.

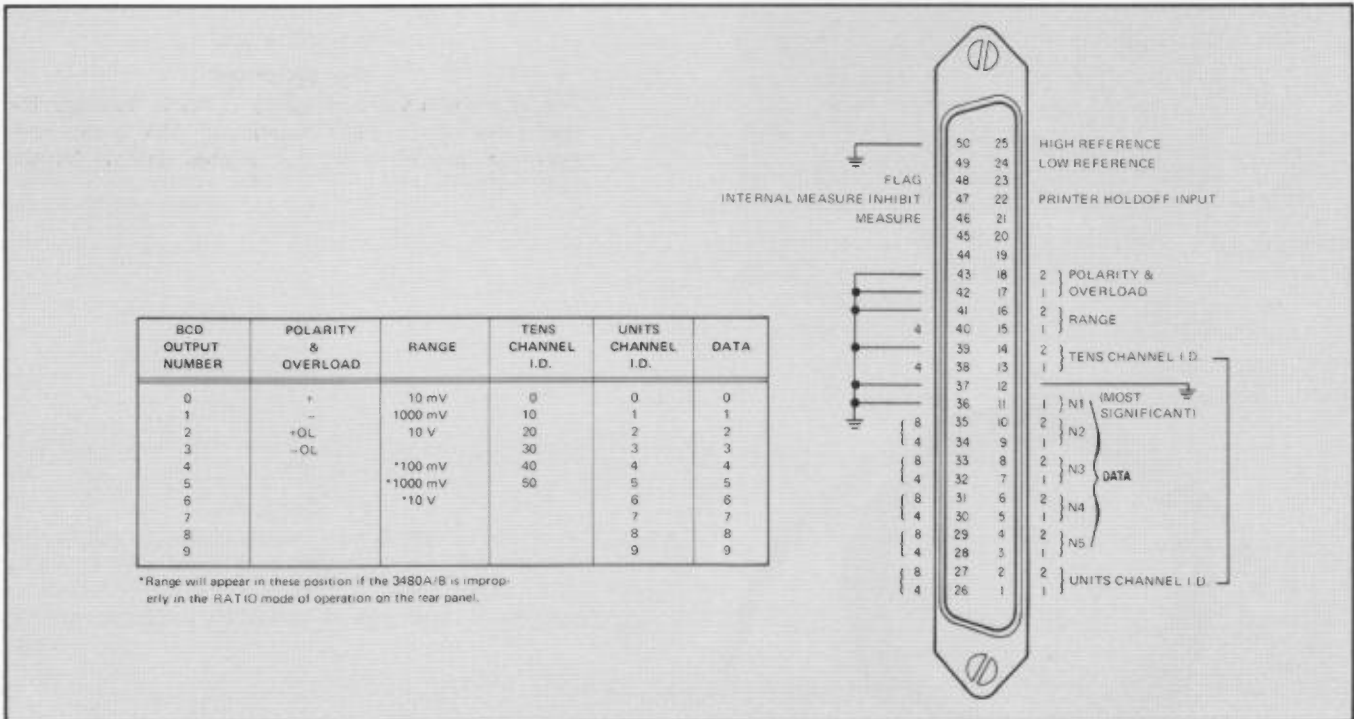


FIGURE 26

Pin assignments for BCD output connector (located on the 3480A or B mainframe). Output decoding is also shown.



For more information, call your local HP Sales Office or East (201) 265-5000 • Midwest (312) 677-0400 • South (404) 436-6181
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