

# INTERFACING T1

## 062-5984-01

Twenty-two programs provide a variety of interfacing aids from general applications to specific. The individual abstracts describe each program.

Five of the programs must be transferred to their own dedicated tapes. The documentation for each gives specific instructions for accomplishing the transfers.

### Title/

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### Program 1

#### Title: Data Communications Utility

Author: Chris Rotvik  
Tektronix, Inc.  
Irvine, CA

Memory Requirement: 8K

Peripherals: Opt 1 (RS-232)

Statements: 135

Files: 1 ASCII Program

The program provides a means by which to transfer data files (or programs) between 4050 Series Desktop Computers utilizing telephone lines and the optional Data Communications Interface (Opt 1).

#### Features Include:

1. Input and output files may be ASCII or binary.
2. Interactive program allows operator selection of:
  - A. Baud rate
  - B. Transmit or receive
  - C. Input or output file number
  - D. Output file format (ASCII or binary) if file format is not currently defined
3. Software communication protocol.
4. Transmission error detection.

4. The mnemonic.
5. The operand.

The 4051R06 or 4052R06 Editor ROM Pack may be used to insert comments into the listing, change absolute addresses and operands to labels and symbols and to insert equate statements.

The program produces a source code-like listing from HEX/ASCII object code. The object code must reside on a 4050 tape file. The source code listing can be directed to the 4050 screen or internal tape unit, a 4641 Printer or a GPIB device.

The object code must be in HEX/ASCII. Only the hexadecimal characters 0 through 9 and A through F are allowed. The object file must contain only the HEX/ASCII representation of machine-executable code.

The source listing is divided into five fields:

1. The byte count in decimal
2. The value of the program counter in HEX.
3. The op-code and operand in HEX/ASCII.

### Program 2

#### Title: MC6800 Disassembler

Authors: Ed Sawicki  
Joe Boim  
Tektronix, Inc.  
Long Island, NY

Memory Requirement: 8K

Peripherals: Optional-4641 Printer  
4051R06 Editor  
ROM Pack  
or  
4052R06 Editor  
ROM Pack

Statements: 153

Files: 1 ASCII Program  
1 ASCII Data (example)

TEST PROGRAM			
1	1688 8692	LDA #82	
3	1682 878798	STAR 8798	
6	1688 869298	CMP #82	
9	1688 86872A	LDA #87A	
12	1688 86872B	BLT #87A	
14	169D 2785	BEC 1814	
16	168F 8623	LDA #32	
19	168F 8624	STA #32	
20	1613 39	RTS	E90C
21	1688 86800C	JMP E90C	
24	1617 6623	LDA #32	
26	1619 BDFFD1	JEP FFD1	
29	161F BDFFD5	JEP FFD5	
32	161F 868798	LDA #8798	
35	1624 8687A0	BLT #87A0	
37	1624 8687A8	BEC 1814	
40	1629 6623	BITA #82	
42	1629 6774	BRK #82	B1F
44	162B BDFFD7	JSP FBD7	
47	1631 BDFFD1	JEP FFD1	
50	1631 BDFC24	JSP FC24	
53	1634 7ECD8F	JMP CBBF	

### Program 3

#### Title: Camera Triggering Circuit

Authors: Steven Fahnestiel  
William Retallack  
NOAA  
Boulder, CO

Memory Requirement: Determined by user program

Peripherals: User-built Interface  
16mm Camera

Statements: 14  
Documentation Only

Animation has allowed us to show motions of particle populations in the earth's magnetosphere as a function of time, and provided a way to correlate data from two nearby satellites into a two-dimensional picture of boundary motion.

A surplus 16mm single-frame camera with a 25mm Angenieux lens is used for filming. The camera has a solenoid-operated

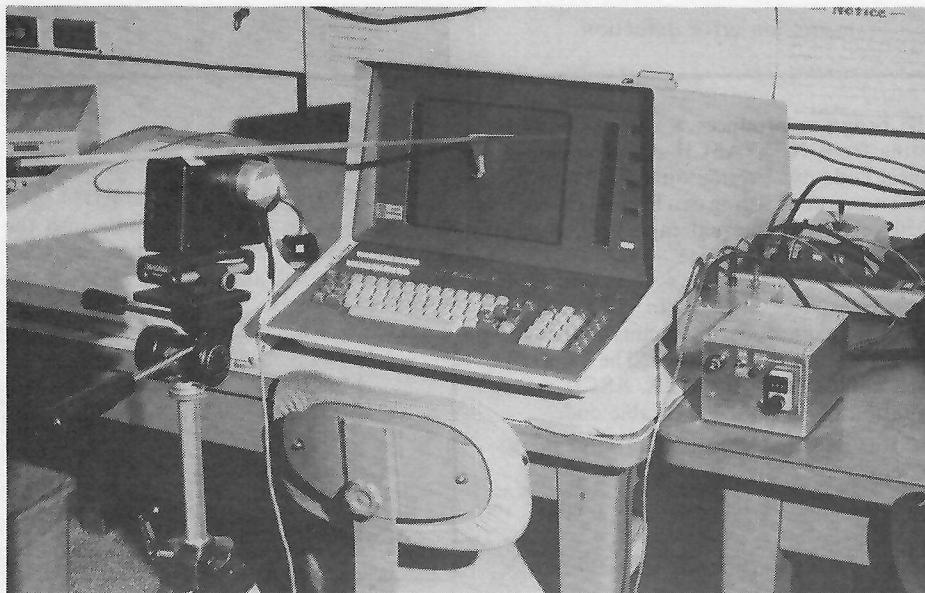
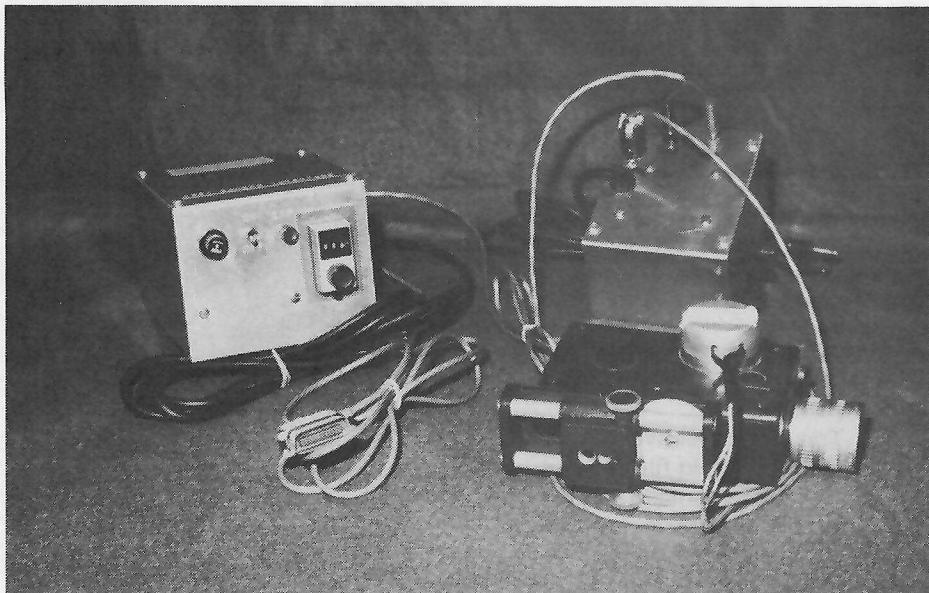
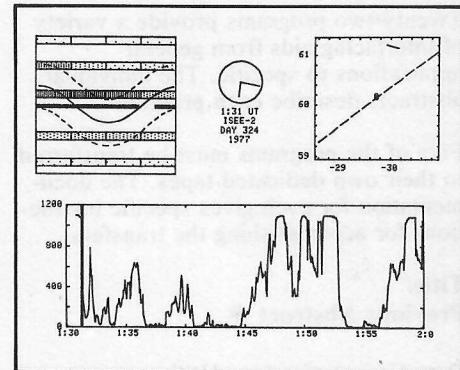
guillotine shutter in which shutter speeds are determined by the duration of the applied current. The specially designed interface uses the signal lines off the GPIB. In 16mm format, plus-x reversal film at ASA 50 allows resolution limited only by that of the graphic system.

The camera is tripod mounted and roughly centered before the screen. Using a PRINT @32,21:65,50 statement, a reference point is drawn at the screen's center. Fine adjustment is done using a jig consisting of a square rod with two orthogonal vanes at its end. The camera is then positioned so that the vanes lie flush against the screen surface, with the rod aligned along the camera axis and centered on the screen. Camera-to-screen distance is 22 inches using f5.6 with a shutter speed of 1.5 sec.

A subroutine triggers the shutter one or more times in succession, followed by eight PAGE

commands to reinitialize the automatic origin position.

Documentation includes interface schematics.



## Program 4

### Title: GPIB Frequency Response Measurement

Author: Phil Somerset  
Tektronix, Inc.  
Rockville, MD

Memory Requirement: 8K

Peripherals: Optional-4662 Plotter

Statements: 240

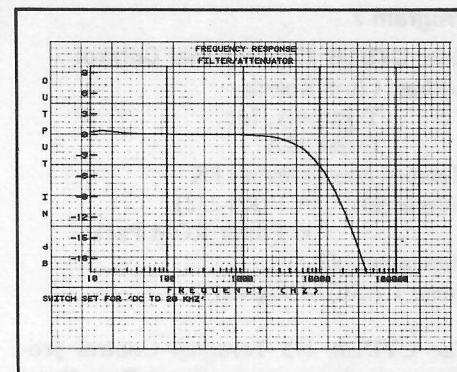
Files: 1 ASCII Program

This program uses a Fluke 6011A Synthesized Signal Generator and a Fluke 8502A Digital Multimeter to measure the frequency response of any device working in the range 10 Hz to 1 MHz. The device under test may be a passive device, such as a resistor, inductor, filter, transformer, etc., or it may be a voltage or power amplifier. Input of test parameters is interactive and the results are

graphed on a logarithmic scale and documented with user-supplied data. The output graph may be directed to the 4662 Plotter.

User-supplied data:

Device type  
Frequency range (default is 20 Hz to 20 kHz)  
Name of device under test (graph title)  
Additional text (up to 3 lines to appear in lower left corner)



User-Definable Keys allow user to:

Perform test  
Change set-up  
Redraw graph  
Plot graph

## Program 5

### Title: Paper Tape Labeler

Author: G.L. Evans  
Herne Hill, London, England

Memory Requirement: 8K

Peripherals: Paper Tape Punch

Statements: 95

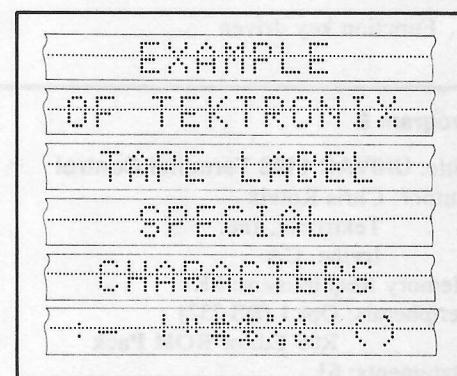
Files: 1 ASCII Program

When the 4050 is used to drive a paper tape punch, this program allows a visual header to be punched in the beginning of a paper tape for easy identification.

A leader of 50 nulls is first punched, and a header of 72 characters maximum is entered

into the 4050 via the keyboard. All of the usual editing facilities of the 4050 may be used at this time. The header is then coded in a standard 5 x 7 matrix and punched, followed by a trailer of 50 nulls.

An example of one type of system used in this mode is the punch on an ASR teletype connected to the 4050 via the IEEE bus (GPIB). The conversion between the IEEE standard and the teletype logic is done using a microprocessor programmed to allow the teletype to be used in the commands SAVE @1: and PRINT @1: so that data can be sent after the header.



## Program 6

### Title: A/D Sampling and Modification

Author: Barry T. Bates  
Dept. of Physical Education  
University of Oregon  
Eugene, OR

Memory Requirement: 24K, 32K best

Peripherals: 40501R05 Binary ROM Pack  
TransEra 652-ADC A/D  
Converter ROM Pack

Statements: 401

Files: 1 ASCII Program

Sixteen data channels can be monitored over three different voltage ranges of  $\pm 10$ , 2.4 and 0.3 volts with resolutions of 5, 1.2 and .16 mV. Single channel sampling rates of 38,819 and 23,496 samples/sec are possible with 8-bit and 12-bit mode respectively. Multi-channel sampling rates are limited to 9000 samples/sec.

The ROM Pack A/D provides 12 routines for operating, manipulating and displaying the data. In addition to controlling the ROM Pack routines through the User-Definable Keys, the control program provides an additional five functions.

Initialize program

Bit resolution  
Voltage range  
Number of channels  
Sampling order  
Sampling rate  
Sample total

Sampling

Keyboard  
Automatic triggering  
Designate channel  
Input voltage  
Pre-trigger values

Unpack data (string to array—floating point)

Unpack 2 data (string to array—raw voltages)

Pack data (array to string)

Modify/scale data

Graph data

Print data

Summarize/change parameters

Data to tape

Data from tape

Delete data points

## **Program 7**

**Title: CYBER 175 Terminal Control**

**Author:** Chris Rotvik  
Tektronix, Inc.  
Irvine, CA

**Memory Requirement:** 8K

**Peripherals:** Opt 1 (RS-232)  
R06 Editor ROM Pack

**Statements:** 63

**Files:** 1 ASCII Program

The CYBER 175 Terminal Control program sets the proper optional Data Communications Interface (Opt 1) parameters and modes to interface a 4050 Series Desktop Computer to the CYBER 175 host computer.

Features are:

1. Function key driven

## **Program 8**

**Title: UNIVAC 1108 Terminal Control**

**Author:** Chris Rotvik  
Tektronix, Inc.  
Irvine, CA

**Memory Requirement:** 8K

**Peripherals:** Opt 1 (RS-232)  
R06 Editor ROM Pack

**Statements:** 63

**Files:** 1 ASCII Program

The UNIVAC 1108 Terminal Control program sets the proper optional Data Communications Interface (Opt 1) parameters and modes to interface a 4050 Series Desktop Computer to the UNIVAC 1108 host computer.

Features are:

1. Function key driven

## **Program 9**

**Title: PDP 11/40 Interface to the 4050 Graphic System**

**Author:** Joan M. McDonald  
Department of Defense  
Ft. Meade, MD

**Memory Requirement:** 8K

**Peripherals:** Option 1 Data Communications Interface  
PDP 11/40

**Statements:** 62

**Files:** 1 ASCII Program

This program provides an interface between the TEKTRONIX 4050 Graphic System and a PDP 11/40 computer which uses the RSX 11M system.

2. Provides the following modes of operation:

A. Terminal mode

B. Data receive mode (from the system editor)

C. Data send mode (to the system editor)

D. Editor mode (utilizing the R06 Editor ROM Pack)

3. Designed around the need to perform editing offline from the host computer

2. Provides the following modes of operation:

A. Terminal mode

B. Data receive mode (from the system editor)

C. Data send mode (to the system editor)

D. Editor mode (utilizing the R06 Editor ROM Pack)

3. Designed around the need to perform editing offline from the host computer

Three options are available:

Option 1:

1. "T" puts the TEKTRONIX 4050 System into Terminal mode as a terminal on the PDP 11/40.
2. "S" sends a tape file to the PDP 11/40.
3. "R" receives a tape file from the PDP 11/40.

Option 2 is used with the TSX 11M EDIT utility program.

Option 3 is used with PIP utility program.

## Program 10

Title: **4050/468 Utility**

Author: Craig Bulmer  
Tektronix, Inc.  
Chicago, IL

Memory Requirement: 32K

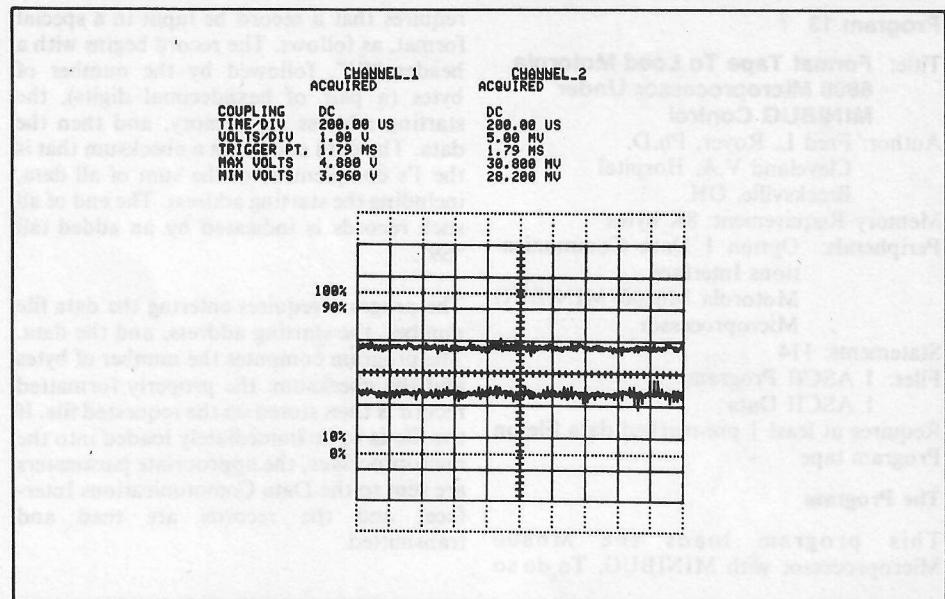
Peripherals: Tektronix 468 - Oscilloscope  
Optional 4662/3 Plotter

Statements: 463

Files: 1 ASCII Program

Requires dedicated data tape

This program will take waveforms from the 468 Oscilloscope and display the waveforms on the 4050 screen; with printed header information of Channel 1, 2 and/or Add; Volts/Div; Time/Div; Trigger Point; Max Volts; and Min Volts. Waveforms can be saved to tape and re-displayed from tape. Output to either screen or plotter with reference scope grid. Waveforms displayed from tape are displayed as dots.



## Program 11

Title: **20 mA Current Loop Interface**

Authors: William M. Retallack  
John H. Taylor  
NOAA  
Boulder, CO

Memory Requirement: 8K

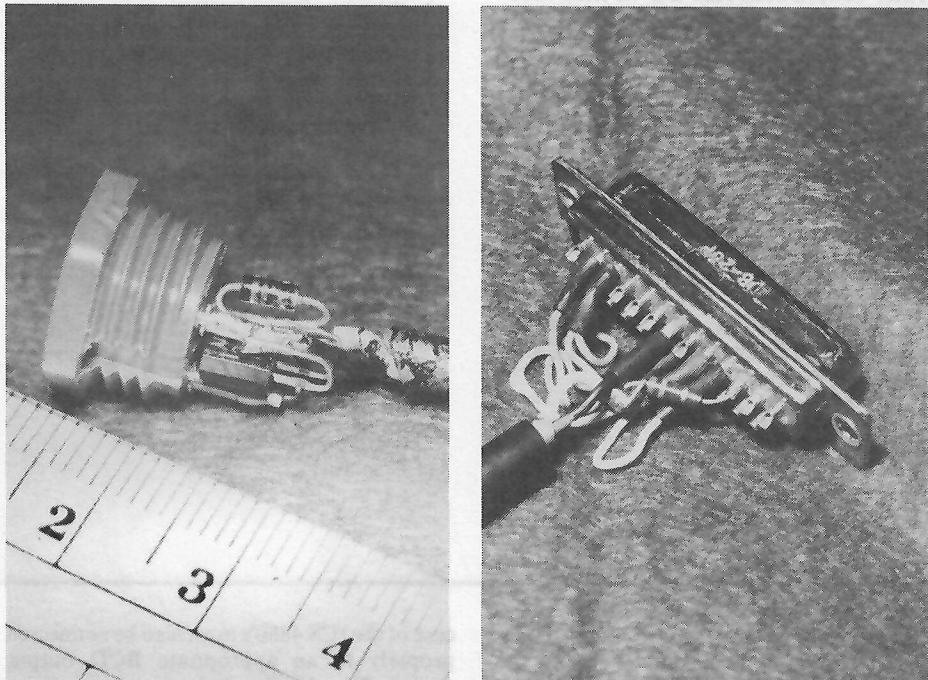
Peripherals: Model 33 Teletype

Statements: 52

Files: 1 ASCII Program

One of the many different tasks we have in data reduction is digitizing analog data and outputting long lists of X and Y values. To save on the cost of hard copy paper, a special interface was constructed. The analog data is digitized, scaled and the output is listed on a Model 33 Teletype. It has been in use for over three years and hasn't dropped a bit yet.

The interface connects through the RS-232 plug. Complete schematics are included in the documentation along with a short digitizer and output program.



## Program 12

Title: **LORAN-C Receiver Interface to 4050**

Author: Peter G. Mauro  
Dept. of Transportation  
Cambridge, MA

Memory Requirement: 8K

Peripherals: Northstar LORAN-C Model 6000 Receiver  
Northstar Interface Adaptor 6700  
Option 1 Data Communications Interface

Statements: 94

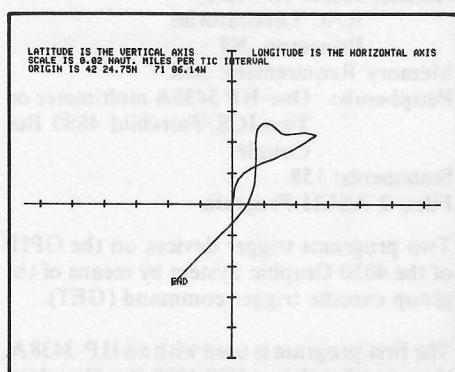
Files: 1 ASCII Program

Requires pre-marked data files

The program accepts serial information from a LORAN-C receiver and stores it on tape. It will plot the latitude and longitude position of the LORAN-C receiver on the 4050 Screen as both are driven along a roadway. It will plot directly from the receiver or from the data stored on tape.

It doesn't plot the latitude and longitude position directly but takes a running average of five consecutive readings to smooth out the plotted curve.

Areas of application include emergency vehicle dispatch and fishing craft path plotting.



### **Program 13**

**Title: Format Tape To Load Motorola 6800 Microprocessor Under MINIBUG Control**

**Author:** Fred L. Royer, Ph.D.  
Cleveland V.A. Hospital  
Brecksville, OH

**Memory Requirement:** 8K bytes

**Peripherals:** Option 1 Data Communications Interface  
Motorola M6800/MINIBUG Microprocessor

**Statements:** 114

**Files:** 1 ASCII Program  
1 ASCII Data

**Requires at least 1 pre-marked data file on Program tape**

#### **The Program**

This program loads the M6800 Microprocessor with MINIBUG. To do so

requires that a record be input in a special format, as follows. The record begins with a header "S1", followed by the number of bytes (a pair of hexadecimal digits), the starting address in memory, and then the data. The data ends with a checksum that is the 1's complement of the sum of all data, including the starting address. The end of all such records is indicated by an added tail "S9".

The program requires entering the data file number, the starting address, and the data. The program computes the number of bytes and the checksum; the properly formatted record is then stored on the requested file. If the file is to be immediately loaded into the microprocessor, the appropriate parameters are sent to the Data Communications Interface, and the records are read and transmitted.

The program is limited to a maximum of 128 bytes of two hexadecimal digits per file. (These are 1 header byte, 1 byte count, two starting address, 122 data, 1 checksum and 1 tail.)

#### **Data Tape Structure**

The data is stored in an ASCII file. Use of File 2 is mandatory; additional files are optional. The format is identical to the punched tape format for the Motorola M6800/MINIBUG microprocessor. An index is not required. The data file is located on the program tape; be sure data file(s) are previously marked.

### **Program 14**

**Title: 4050/QUANTEX DS-12 Interface**

**Author:** John Carter  
Tektronix, Inc.  
Santa Clara, CA

**Memory Requirement:** 32K

**Peripherals:** QUANTEX DS-12 Image Processor

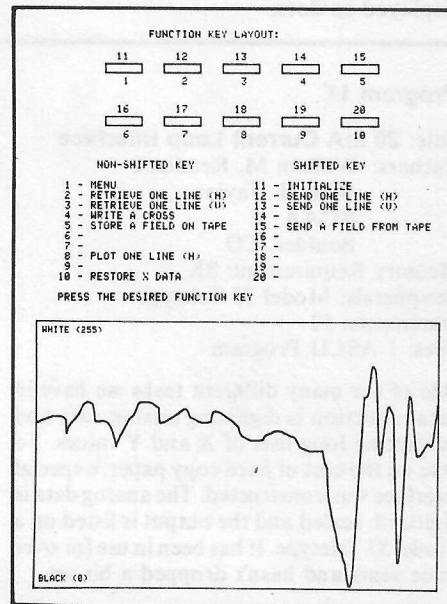
**Statements:** 266

**Files:** 1 ASCII Program

The program provides an interface between the 4050 Series Graphic System and a QUANTEX DS-12 Image Processor. Use the 4050 System to control and modify the video frame captured by a QUANTEX DS-12 Image Processor.

The User-Definable Keys are used to perform the following functions:

- Retrieve one horizontal line
- Retrieve one vertical line
- Send one horizontal line
- Send one vertical line
- Plot one horizontal line
- Write a cross
- Store a field on tape
- Send a field from tape
- Restore X data



### **Program 15**

**Title: GPIB GET Command Trigger**

**Author:** James R. Matey  
RAC Laboratories  
Princeton, NJ

**Memory Requirement:** 32K

**Peripherals:** One-HP 3438A multimeter or Two-ICS/Fairchild 4880 Bus Coupler

**Statements:** 158

**Files:** 2 ASCII Program

Two programs trigger devices on the GPIB of the 4050 Graphic System by means of the group execute trigger command (GET).

The first program is used with an HP 3438A, the second with two ICS 4880 Bus Couplers. The device(s) must be connected via the appropriate cables to the 4050, and in the

case of the ICS 4880's must also be connected properly to an appropriate BCD output device. The details of the connections are presented in the manufacturers' instructions for these devices.

These programs are used to automate laboratory experiments allowing the 4050 to read the results of a measurement.

## **Program 16**

**Title: Tektronix/Hewlett Packard 488 Interface**

**Author:** Robert Cope  
Michael Bowman  
Atlantic Analysis Corporation  
Norfolk, VA

**Memory Requirement:** 8K

**Peripherals:** Hewlett Packard 9835 or 9845

**Statements:** 70

**Files:** 1 ASCII Program  
1 ASCII Text

This program transfers messages input from the keyboard of an HP 9835 to a TEKTRONIX 4051 and vice versa. The purpose is to demonstrate the capability of the HP 9835 and TEKTRONIX 4051 to

communicate using the standard IEEE-488 Interface Bus to demonstrate the interrupt capabilities and limitations of both computers. The configuration simulates an interconnection between a TEKTRONIX 4054 and a Hewlett-Packard 9845 which were not available at the time the evaluation was conducted.

processor to devote full time to their respective tasks, being interrupted only to service operation requests or intercomputer communications needs on a time available basis ensuring that the high priority message processing is never neglected.

The complete evaluation is included as part of the documentation.

Communications using the 488 bus will make it possible to off load the graphics processing load in ECLIPS tactical display systems to an intelligent graphics display which will free the other computer for message processing and textual information display. The interrupt capabilities of the machines will make it possible for each

## **Program 17**

**Title: Hardware Modification HP 59306A Relay Actuator**

**Author:** Tyler Coplen  
U.S. Geological Survey  
Reston, VA

**Memory Requirement:** 8K

**Peripherals:** Hewlett Packard 59306A  
Relay Actuator

**Statements:** 37

**Files:** 1 ASCII Program

This program uses the 4051 as a controller to open and close each of six independent

double-throw relays in the HP 59306A Relay Actuator. The control is through the User-Definable Keys. The HP operates on the HPIB (Hewlett Packard's implementation of the IEEE Standard 488-1975). With a minor modification of the HP 59306A hardware, it can be controlled with the 4051. The hardware modification consists of connecting REN (remote enable of the HP 59306A) to common. The modification is described in detail. The only drawback of this modification is that the HP 59306A must be powered off and on to exit from the Local Lockout (LLO) mode.

## **Program 18**

**Title: Hewlett-Packard Interface Package**

**Author:** Peter O. McVay  
Program Specialist  
Norfolk Public Schools  
Norfolk, VA

**Memory Requirement:** 16K

**Peripherals:** Option 1 Data Communications Interface

**Statements:** 481

**Files:** 13 ASCII Program  
Requires dedicated tape

The menu provides operation control for the routine. The entire interface package allows you to:

1. Log on and off the HP2000 series computers,
2. Interface in terminal mode,
3. Restore and store HP programs on the 4051 tape system,
4. Store and restore HP files using HP utility programs \$FCOPY and \$EDITOR,
5. Connect the TEKTRONIX 4051 to any RS-232 EIA-compatible hardcopy terminal for listing or printing (terminal may be used as a line printer only).

The system is internally documented, and maintains continuous control of the two computers. Pressing Overlay Key 5 (RETURN TO BASIC) returns control to the MENU.

## **Program 19**

**Title: HP/Tektronix/Amdahl Interface**

**Author:** Subarna M. Malakar  
1305 South Main St.  
Gainesville, FL

**Memory Requirement:** 8K

**Peripherals:** Option 1 Data Communications Interface  
Hewlett Packard 99810A programmable calculator  
Hewlett Packard 11205A Interface  
Amdahl 470 V/6-II with OS/MVS Release 3.8 and JES2 NJE Release 3 at NERDC, U. of Fla.

**Statements:** 241

**Files:** 5 ASCII Program  
1 ASCII Data (example)  
Requires dedicated tape

The programs perform the following functions:

1. Directory
2. TCP-SIGN ON—Allows 4051 to operate as a terminal to the host computer at 1200 baud. It prompts the user to sign-on to the host computer on TCP mode, and to execute select TCP commands by returning to BASIC.
3. TCP to TEK—Allows a TCP file from the host computer to be sent to a tape file on the 4051.

4. TEK TAPE to TCP—Allows data on 4051 tape to be sent to TCP workfile.
5. HP to TEK TAPE—Allows data from HP 9810A system cassette files to be transferred and stored in 4051 tape files. External switching is required to change the interface to HP 9810A. Certain prompting control characters must be sent from HP 9810A through the PARAMETER LIST key for other conditions.

## Program 20

Title: **4050 IEEE ARGUS Display Sub-**

**System Interface**

Author: Chuck Paulsen

E.I. DuPont

Newton, CT

Memory Requirement: 8K

Peripherals: Option 1 Data Communi-

cations Interface

IEEE-ARGUS Alphanumeric

Display Subsystem (Plasma

Dot Matrix)

Statements: 316

Files: 5 ASCII Program

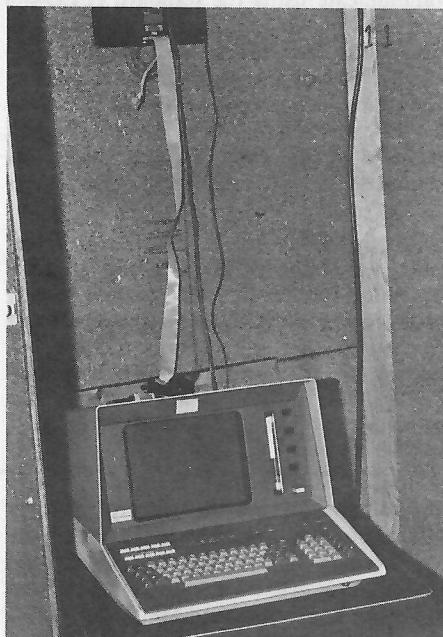
1 Binary Data (example)

Requires dedicated tape

We use the 4051 to drive our ARGUS display. The first program prompts for the "pages" of 8-line messages to display and the time delay between messages. It converts the messages into the special six-bit code required by the display device, and stores the messages and display time on tape.

A second program reads the information from the data file and outputs one page at a time to the display.

File 1 is a directory. Files 2 and 3 contain the programs which have no REMark statements in order to conserve on memory. Files 4 and 5 contain the programs documented with REMark statements.



## Program 21

Title: **Controlling FFT Operations from Tape**

Authors: L.D. Mitchell

John H. Herold

Donatus C. Ohanehi

Mechanical Engineering Dept.

Virginia Polytech. Inst. & State Univ.

Blacksburg, VA

Memory Requirement: 8K

Peripherals: Zonic Technical Laboratories

FFT System Model 5003

Option 1 Data Communications Interface

Statements: 147

Files: 2 ASCII Program

4 ASCII Data (examples)

Requires dedicated tape

These programs enable the user to automate FFT operations using the ZTL 5003 FFT machine. They also simulate the batch routine option available on ZTL's FFT.

Repetitive FFT operations may be controlled from tape. One program prompts the user to input FFT commands, delays to allow viewing, copying and transmitting of next commands and screen paging. These are stored in user-specified pre-marked data files.

A second program transmits FFT commands on tape to the FFT system, displays the commands and plots.

A third program loads FFT batch programs from 4050 tape into the FFT memory then allows interaction for editing or execution.

Theory, method and examples are all included in the documentation.

## **Program 22**

**Title: 4050/492P Utility**

**Author:** David B. Green  
Tektronix, Inc.  
Beaverton, OR

**Memory Requirement:** 32K

**Peripherals:** 492P Spectrum Analyzer  
Optional-4662 Plotter

**Statements:** 1286

**Files:** 8 ASCII Program

9 ASCII Data

7 Binary Data

Requires dedicated tape

This is a demonstration software package, however, it contains many useful algorithms that can be adapted for personal application programs. The following are the sub-programs in this package.

### **Indexing/Menu**

Contains the initial control structure for the entire package. Used to access desired sub-programs and also contains a complete list of 492P commands. This sub-program also allows direct control of the analyzer over the GPIB bus.

### **492P Waveform Transmission**

Establishes a single keystroke approach which allows you to either transmit or receive waveform data. Instrument Front Panel Settings may also be transmitted or received along with each corresponding waveform. Provides for simple data storage to magnetic tape which will allow you to store measurement conditions and data. By the stroke of a few User-Definable Keys, the 492P can be made to re-configure to previously made measurement parameters.

### **Spectrum Analysis**

Provides rapid spectrum analysis from sweeps made on the 492P. Two types of analysis are provided:

- 1) This analysis lists and graphs the frequencies to either side of the signal at center screen. Sideband measurements are made easy with this portion of the program.
- 2) Direct frequency measurements are the function of this section. All signals appearing on screen are cataloged and listed on the controller.

### **492P Command Syntax Tutorial**

This is a complete tutorial provided for the novice. The tutorial provides for the user comprehensive instruction in the use of the GPIB command syntax used in the 492P. As each item is presented, the user is allowed to "experiment" with each command with help as needed provided by the controller. Periodic review of this section keeps one's programming skills at a maximum.

### **Total Harmonic Distortion**

This sub-program was provided especially for sales personnel. It operates using only the internal calibrator signal provided in the 492P. The program automatically searches for and measures all requested harmonics of a given frequency and computes the total Harmonic distortion. Measurement results are provided in a neat graphics format.

### **Utility Programs**

Duplicate tapes. Name tape file headers to use for data storage.