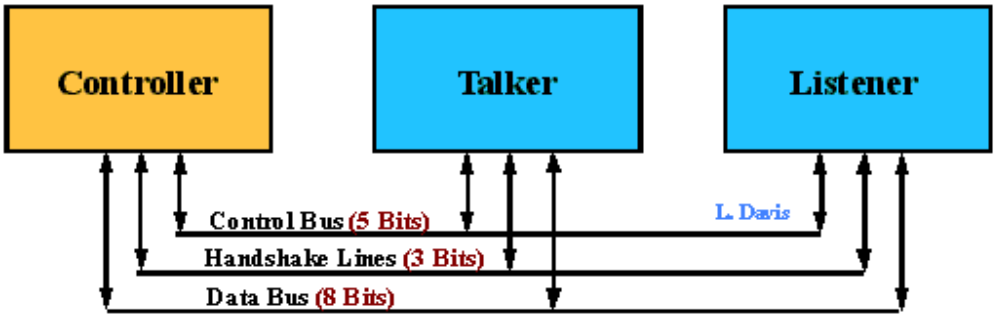
GPIB Description [IEEE488]



The IEEE-488 interface bus, also known as the General Purpose Interface Bus "GPIB" is an 8 bit wide byte serial, bit parallel interface system which incorporates:

- 5 control lines
- 3 handshake lines
- 8 bi-directional data lines.

The entire bus consists of 24 lines, with the remaining lines occupied by ground wires. Additional features include: TTL logic levels (negative true logic), the ability to communicate in a number of different language formats, and no minimum operational transfer limit. The maximum data transfer rate is determined by a number of factors, but is assumed to be 1Mb/s.

Devices exist on the bus in any one of 3 general forms:

1. Controller
2. Talker
3. Listener

A single device may incorporate all three options, although only one option may be active at a time. The Controller makes the determination as to which device becomes active on the bus. The GPIB can handle only 1 ‘active’ controller on the bus, although it may pass operation to another controller. Any number of active listeners can exist on the bus with an active talker as long as no more then 15 devices are connected to the bus.

The controller determines which devices become active by sending interface messages over the bus to a particular instrument. Each individual device is associated with a 5 bit BCD code which is unique to that device. By using this code, the controller can coordinate the activities on the bus and the individual devices can be made to talk, listen (un-talk, un-listen) as determined by the controller. A controller can only select a particular function of a device, if that function is incorporated within the device; for example a ‘listen’ only device cannot be made to talk to the controller.

- The Talker sends data to other devices.
- The Listener receives the information from the Talker.

In addition to the 3 basic functions of the controller, talker, and listener the system also incorporates a number of operational features, such as; serial poll, parallel poll, secondary talk and listen addresses, remote/local capability, and a device clear (trigger).

Device dependent messages are moved over the GPIB in conjunction with the data byte transfer control lines. These three lines (DAV, NRFD, and NDAC) are used to form a three wire 'interlocking' handshake which controls the passage of data. The active talker would control the 'DAV' line (Data Valid) and the listener(s) would control the 'NRFD' (Not Ready For Data), and the 'NDAC' (Not Data Accepted) line.

In the steady state mode the talker will hold 'DAV' high (no data available) while the listener would hold 'NRFD' high (ready for data) and 'NDAC' low (no data accepted. After the talker placed data on the bus it would then take 'DAV' low (data valid). The listener(s) would then send 'NRFD' low and send 'NDAC' high (data accepted). Before the talker lifts the data off the bus, 'DAV' will be taken high signifying that data is no longer valid. If the 'ATN' line (attention) is high while this process occurs the information is considered data (a device dependent message), but with the "ATN' line low the information is regarded as an interface message; such as listen, talk, un-listen or un-talk.

The other five lines on the bus ('ATN' included) are the bus management lines. These lines enable the controller and other devices on the bus to enable, interrupt, flag, and halt the operation of the bus.

All lines in the GPIB are tri-state except for 'SQR', 'NRFD', and 'NDAC' which are open-collector. The standard bus termination is a 3K resistor connected to 5 volts in series with a 6.2K resistor to ground - all values having a 5% tolerance.

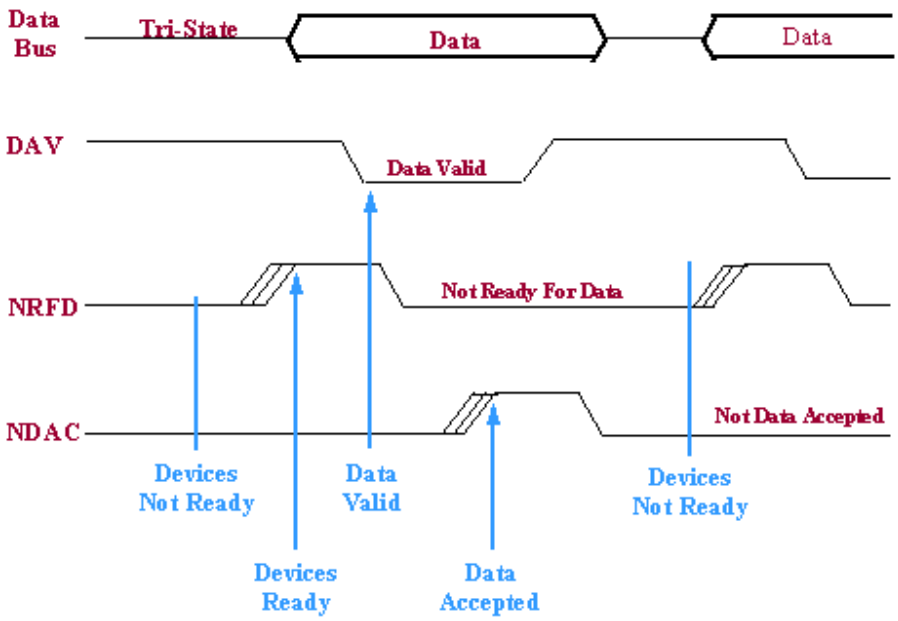
The standard also allows for identification of the devices on the bus. Each device should have a string of 1 or 2 letters placed somewhere on the body of the device (near or on the GPIB connector). These letters signify the capabilities of the device on the GPIB bus.

- C Controller
- T Talker
- L Listener
- AH Acceptor Handshake
- SH Source Handshake
- DC Device Clear
- DT Device Trigger
- RL Remote Local
- PP Parallel Poll
- TE Talker Extended
- LE Listener Extended

Devices are connected together on the bus in a daisy chained fashion. Normally the GPIB connector (after being connected to the device with the male side) has an female interface so that another connector may be attached to it. This allows the devices to be daisy chained. Devices are connected together in either a Linear or Star fashion.

Most devices operate either via front panel control or HPIB control (REMOTE). While using the front Panel the device is in the Local state, when receiving commands via the HPIB, the device is in the Remote state. The device is placed in the Remote state whenever the System Controller is reset or powered on,; also, when the system controller sends out an Abort message. In addition, if the device is addressed, it then enters the Remote state.

IEEE488 Data Bus Transfer Timing



GPIB Bus Handshake Timing

The IEEE488 bus operates at the speed of the slowest device, all devices have to be ready before operation begins. Signals are active low. Data is transferred asynchronous, using the Handshake lines instead of a clock. Only Parallel Polling does not use the Handshake, all other transfers use Hand-shaking.

HS488 High-Speed GPIB Handshake Protocol Hand shake protocol [not shown above], increases bus transfers to 8MBytes/s with other HS488 devices. NDAC is not required to Handshake, the Talker outputs data with DAV, waits then outputs new data with DAV without NDAC occurring.