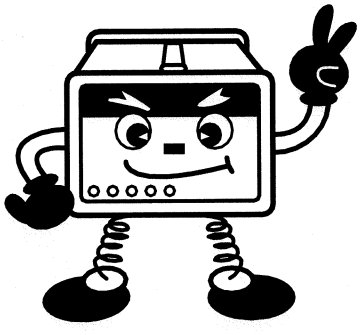
GPIB Interface 10



GPIB

Practical actions and programming are dependent on the programming language on the controller side and the GPIB driver.
For further information, see the manuals for the programming language and the GPIB driver used.

a) Functions that cannot be operated through GPIB

- Turning ON/OFF the power
- Initialization to the original setting made on shipping.
- GPIB address and the terminator for sending

b) Functions that can be controlled through GPIB, but cannot be operated from the panel

- GPIB proper functions (status byte, remote/local etc.)

c) Underlying codes

- Standard: conforming to IEEE std. 488.1-1987
- Interface functions (listed below)

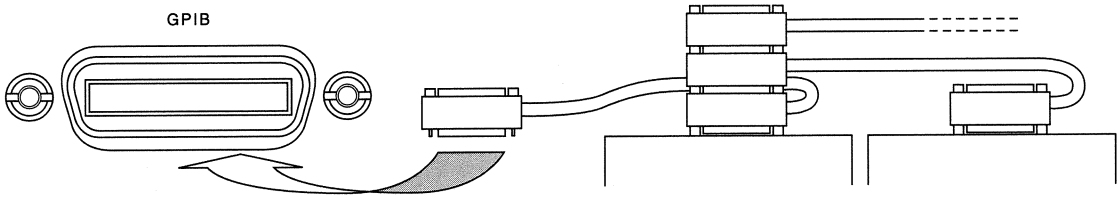
Interface Functions

SH1	Provides all functions of source handshake
AH1	Provides all functions of acceptor handshake
T16	Provides functions of fundamental talker, serial poll, and talker release by listener designation, but without talk only function
L4	Provides functions of fundamental listener, and listener release by talker designation, excluding listen only function
SR1	Provides all functions of service request
RL1	Provides all functions of remote/local
PP0	Does not provide parallel poll function
DC1	Provides all functions of device clear
DT1	Provides all functions of device trigger
C0	Does not provide controller function

Connection of GPIB cable

The connector for GPIB connection is located on the rear panel.

Using a GPIB cable specified by the standard, connect it to the GPIB bus line. Before connection to the bus, turn off the power switch of all devices to be connected. Tighten the joining screws of the connector to prevent loosening.



Connection of GPIB Cable

Instructions on use of GPIB

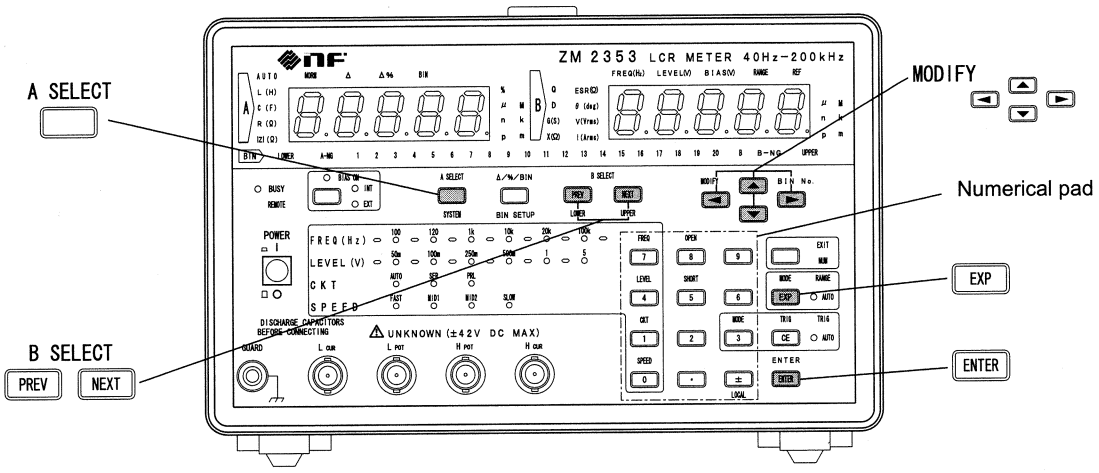
To use a GPIB, the following instructions must be observed in general.

- Turn off the power switch of all devices that are connected to the bus before plugging or unplugging the GPIB connector. Plugging or unplugging the connector with the power switch turned on may damage the devices.
- Turn on the power switch of all devices connected to the bus during GPIB use.
- Up to 15 devices including the controller can be connected to one bus.
- Length of cables must be the same or shorter as the following length:
  Length of any cable between devices is 4 meter.
  Total length of cables is the number of devices times 2 m or 20 m whichever is shorter.
- Assign different addresses to each device connected to one bus. A same address assigned to different devices may damage the devices.
- Unify the GPIB terminator within the system.

Setting of GPIB address and terminator (system menu)

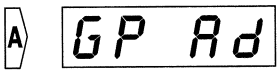
Setting items of GPIB address and terminator are contained in the system menu.

☞ For the method to enter the system menu, see Chapter 7 "System Menu".



GPIB address [GP Ad]

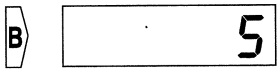
1. Press A SELECT, or MODIFY several times to show [GP Ad] on Display A.



2. Using the numerical pad, make setting of GPIB address.

Example: If the address is 5:

Press 5 and ENTER.



Note

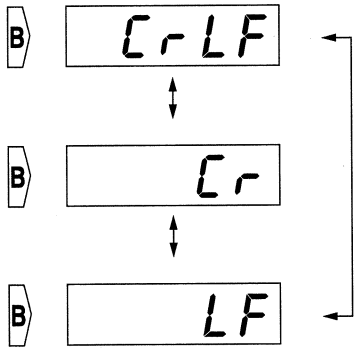
A GPIB address is the ZM2353/ZM2354's address used for communications made with computer through GPIB. The address is a number ranging from 0 to 30. It is set to 2 when the ZM2353/ZM2354 is shipped.

GPIB terminator [GP tr]

1. Press A SELECT, or MODIFY several times to show [GP tr] on Display A.

2. Press B SELECT PREV NEXT or ▲ ▼* to select a GPIB terminator.

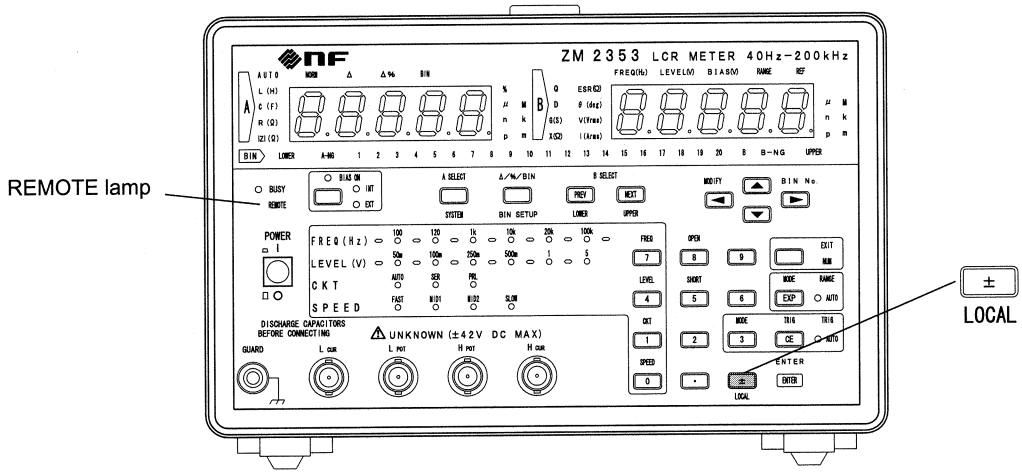
* Every press on the buttons will change the indication of terminators as shown below.



Note

The GPIB terminator will be the ZM2353/ZM2354's terminator (a separator between messages) when communications are made with computer through GPIB. "CrLF" is selected when the ZM2353/ZM2354 is shipped.

Remote status and remote state releasing



Making a device remote

Set REN (Remote ENable) to 1 (True, the line is at LOW level) and send a program message, and it will be in a remote state, disabling operation from the panel (except the operation of ± LOCAL).
In remote state, the REMOTE lamp keeps lighting.
Normally it will remain in remote state even after setting is complete depending on the GPIB driver on the controller side.

Making a device local

To shift it from remote state into local state, press ± LOCAL (except local lockout).
To bring it into local state from the controller, execute either of the following:

- Specify the address and send an interface message, GTL (Go To Local). GTL will make the specified device local.

Bring the system into local lockout

If the system is brought into local lockout from the controller side, pressing ± LOCAL will not make the system local. This measure can help the user avoid wrong operation in remote state. To make local lockout, take the following step:

- Send an interface message, LLO (Local LockOut).
  LLO brings into a local lockout state all devices that are connected to the bus and have the local lockout function.

Service request (SRQ)

Sending SRQ

If SRQ sending is enabled, any of the following events will send SRQ:

- A measurement is finished in manual trigger mode
- OPEN or SHORT zero correction is finished
- Calibration (CAL) is finished

Canceling SRQ

- When status has been read by serial poll during service request sending
- When a query message for status reading ("?ST") is received
- When Device Clear (DCL, SDC command) is received.

Status byte

The contents of a status byte to be sent answering to a serial poll or a query message are as

Bit	Description	Condition to be reset (1)	Condition to be reset (0)
7(MSB)	0 always	--	--
6	RQS	When SRQ is sent	● When Device Clear received ● When status byte is read
5	ZERO ERR	When zero correction error has occurred (too high correction)	● When Device Clear received ● When status byte is read ● When zero correction is completed in success
4	EOM	When measurement is being executed (excluding the period of zero correction)	● When measurement is not being executed
3	ZERO	When OPEN or SHORT zero correction is completed (including abnormal ending)	● When status byte is read ● When starting another zero correction ● When Device Clear received
2	RECALL	When recall is completed	● When status byte is read ● When Device Clear received
1	ERR	When fixable error (error number 00 to 49) has occurred	● When Device Clear received (Other than the above cannot clear the device.)
0 (LSB)	CAL	Self-calibration on power energizing or when gain correction is completed	● When Device Clear received ● When status byte is read ● When another gain correction is to be started

Device clear:

DCL or SDC command

Status byte reading:

Status byte reading by query message "?ST"

Or, serial poll that is made when SRQ is being issued

(Reset is not made by serial poll when SRQ is not being issued)

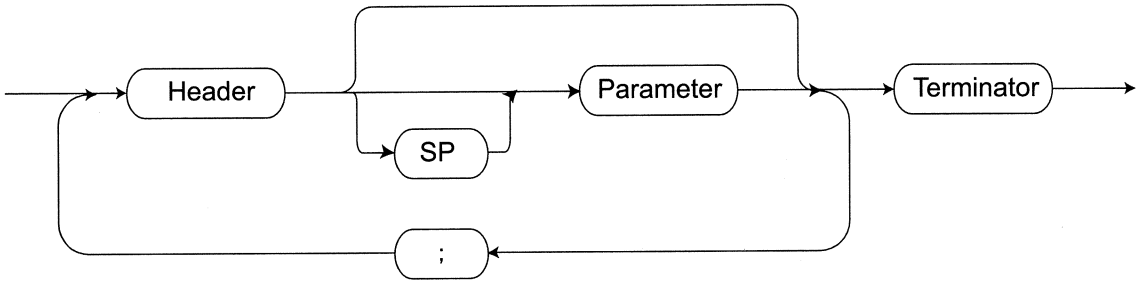
Program message

Program messages are stored temporarily in the input buffer, and when a terminator is received, they will be interpreted and executed in the order of inputting. The input buffer has a capacity of 256 characters (i.e., 256 bytes). Null (00h) and terminator do not enter the input buffer.

When a program message with a size exceeding 256 characters is received, all other program messages will be invalid, and none of the program messages will be executed.

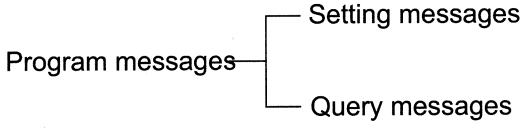
When a program message has been interpreted and executed, the input buffer will be cleared, and will be ready to accept the next input.

A program message consists of a header and a parameter. Program messages can be sent successively if the input buffer capacity is not exceeded. The syntax of a program message is shown below.



When to send two or more program messages, place a semicolon ";" between the messages.

Program messages are broadly classified into "setting messages" to make settings and to command actions and "query messages" to inquire state or setting values.



Setting message

The format of a fundamental setting message is shown below.

This example message sets the frequency to 1 kHz and signal level to 1 V.

FR		1E3	;	LV		1
a	b	c	d	a	b	c

a: Field for a header, consisting of two alphabets. Header is not case-sensitive, allowing mixture of an uppercase and a lowercase.

b: A space(s) to facilitate reading. Any number of spaces can be inserted, and it can also be omitted.

c: Field for a parameter, starting with a sign (+ or –), a number or a decimal point. If a sign is omitted, the parameter is taken as a positive number. Some commands consist of a string as its parameter.

d: This is a semicolon to separate plural setting messages.

Data format of setting message

Formats of data include the following three, NR1, NR2 and NR3. A numerical command can take any of the NR1, NR2 and NR3 formats.

- NR1 format

  Integer format. This format does not contain a decimal point; the decimal point is considered to exist at the right to the final digit.

± DDD

◎ Leading zeros are neglected.

◎ The sign is expressed by "+" or "–", and omitted sign will be taken as "+".

Example: +01234
–50001
18

- NR2 format

  This is a floating-point format to define a value containing a decimal point. A period "." expresses the decimal point. The fraction can be omitted after the decimal point, and if it is omitted, the fraction will be taken as zero.

± DD. DD

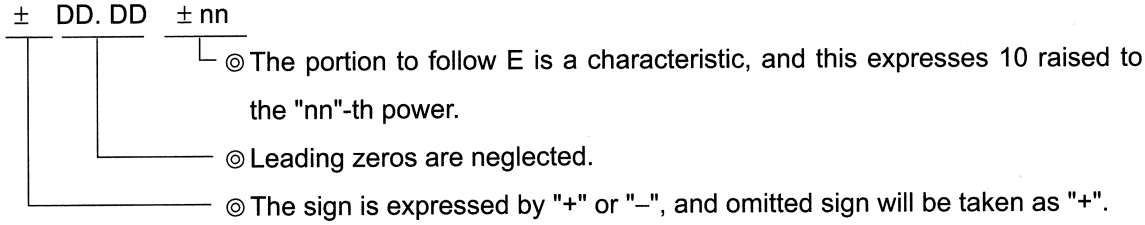
◎ Leading zeros are neglected.

◎ The sign is expressed by "+" or "–", and omitted sign will be taken as "+".

Example: +0.1234
–50.001
1.8

NR3 format

This is an exponential form to define a value with a numbers containing a decimal point and a characteristic. A period "." expresses the decimal point and "E" expresses the exponent.



Example: 12E3
9.8E+0.2
+0.4. 5E–6
–.007E+09

- Characters

  ASCII (ISO 7-bit) codes are used.

- Strings

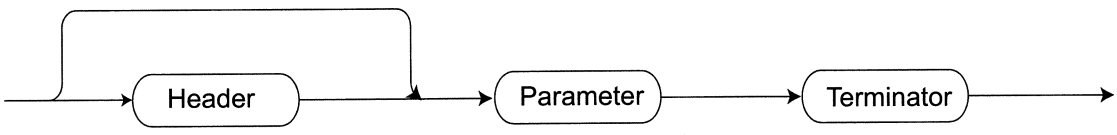
  Combinations of ASCII (ISO 7-bit) codes are used. A string is defined with double quotations placed at the top and the end.

Query message

A program message to inquire the state of selection or set values. Always furnished with a question mark "?" at the top.

If talker is specified when the query message has been sent, a response to it will be output.

The output format of response is as follows:



The header can be turned on or off by the setting message "HD 1" or "HD 0". When the unit is powered, it is turned off ("HD 0", meaning that the header will not be output").

Be careful!

If the user specifies ZM2353/ZM2354 as talker without sending a query message, a space and a terminator will be output except just after measurement by manual trigger.
If two or more queries are made at a time, only the last query will be valid. All other previous queries will be neglected. Note that, if any of the following operation is made without receiving a response after sending a query message, then the response to the query will be cancelled.

- Program message "TG"
- GET command

Data format of response to query

Parameters have the following formats, and the output format and the number of digits (number of characters) are decided by the query message.

- NR1: Integer

  Example: "0", "1" etc.
- NR2: Floating point format (without a characteristic)

  Example: "12.345" etc.

  The place of decimal point may be either fixed or variable.
- NR3: Exponential form (with a characteristic)

  Example: "15.75E + 03" etc.

If NR3 (exponential form) is used, the characteristic will be a multiple of 3 so that the mantissa will be approximately in the range of: $1 \leq |\text{Mantissa}| < 1000$ according to the panel indication, with the characteristic being limited to –12 at the minimum and +6 at the maximum.
In some cases, however, the mantissa may not be within the range from 1 to 1000 due to the indication requirements.
To express zero in the NR3 format, in general, both the mantissa and the characteristic will be zero (i.e., "0.0000E + 00"). For some measurement, however, it may happen that only the mantissa is zero, but the characteristic is not zero according to the panel indication.

Note

- Values are output in right justification with its extra zero removed at the top of the number. However, the zero just before the decimal point will not be omitted.
- For the sign of positive numbers and zero, a blank is used rather than adding a "+" sign. For the sign of characteristic, however, a "+" sign is added instead of using a blank. The characteristic always has two digits.

Program messages

Setting message

The numerical format, range of value and resolution of frequency, trigger delay time, upper and lower limit values of comparator etc. that can be set through the GPIB are the same as those when set from the panel. Also the main and sub parameters, measuring speed etc. are the same as those when set from the panel.

[Example of setting message]

"FR 10E3": To set frequency to 10 kHz.

"DA 0": To automatically set Displays A and B and equivalent circuit.

"RC 2": To call No. 2 of setting memory.

Be careful!

OPEN and SHORT zero correcting action and measurement with manual trigger will be aborted if any program code is received during execution.

Setting messages [Command messages]

Parameter name or function	Program message		Action and setting range	Query
	Header	Parameter		
DISPLAY A	DA	NR1 integer	<Main parameter indication> Range: 0 = A UTO 1 = L 2 = C 3 = R 4 = |Z| 5 to 8 = A UTO	Yes
DISPLAY B	DB	NR1 integer	<Sub parameter indication> Range: 0 = Q 6 = Vm 1 = D 7 = Im 2 = G 8 = FREQ 3 = X 9 = LEVEL 4 = ESR 10 = BIAS 5 = θ 11 = RANGE 12 = REF	Yes
DELTA/BIN	DE	NR1 integer	<Deviation and bin indication> Range: 0 = NOMAL 1 = Δ 2 = Δ% 3 = BIN 4 = ΔBIN 5 = Δ% BIN	Yes

Parameter name or function	Program message		Action and setting range	Query
	Header	Parameter		
BIN MODE	DP	NR1 integer	<Indication during bin action> Selection of indication items on Displays A and B during bin action Range : 0 = Indication of measurement 1 = Indication of upper and lower limit value	Yes
CIRCUIT	CK	NR1 integer	<Equivalent circuit> Range : 0 = AUTO 1 = SER 2 = PRL 3 to 4 = AUTO	Yes
REFERENCE	RF	NR3 exponential form	<Reference value for deviation indication> Range: 0 and ±(0.0001E – 12 to 19999E + 6) Resolution: maximum 4-1/2 digits	Yes
BIN A	BN	NR1 integer and NR3 exponential form	<Main parameter comparator> Format: m1, m2, m3 m1: Bin number (BIN) m2: Lower limit (LOWER) m3: Upper limit (UPPER) Range: m1 = 1 to 20 m2, m3 = 0 and ±(0.0001E – 12 to 19999E + 6)	Yes
BIN B	BB	NR3 exponential form	<Sub parameter comparator> Format: m1, m2 m1: Lower limit (LOWER) m2: Upper limit (UPPER) Range: 0, and ±(0.0001E – 12 to 19999E + 6)	Yes
FREQUENCY	FR	NR3 exponential form	<Frequency> Range: 40 to 200E + 3 [Hz] Resolution: 40 to 99 k = two digits 100 k to 200 k = 1 k [Hz]	Yes
LEVEL	LV	NR3 exponential form	<Measurement signal level> Range: 10E – 3 to 5.0 [Vrms] Resolution: 10E – 3 to 1.0 = 1 m [Vrms] 1.0 to 5.0 = 10 m [Vrms]	Yes
RANGE	RN	NR1 integer	<Range> Range: 0 = FAST 1 = MED range1 ≀ ≀ 6 = MAN range 6 7 to 12 = AUTO	Yes
SPEED	SP	NR1 integer	<Measuring speed> Range: 0 = FAST 1 = MED 1 2 = MED 2 3 = SLOW	Yes
DELAY	DL	NR2 floating point	<Delay time> Time period from triggering to measurement start Only manual trigger Range: 0.00 to 199.99 [s] Resolution: 0.01 [s]	Yes

Parameter name or function	Program message		Action and setting range	Query
	Header	Parameter		
BIAS OUTPUT ON/OFF	BO	NR1 integer	<Bias output> Range: 0 = OFF 1 = ON	Yes
BIAS SWITCH ON/OFF	BS	NR1 integer	<Bias switch> Range: 0 = INT 1 = EXT	Yes
BIAS INTERNAL LEVEL	BI	NR3 exponential form	<Internal bias level> Range: 0 to 2.5 [V] Resolution: 0 to 999E – 3 = 1m [V] 1.0 to 2.5 = 10m [V]	Yes
TRIG MODE	TR	NR1 integer	<Trigger mode> Range: 0 = AUTO 1 = MAN	Yes
MAN TRIG	TG	NR1 integer	<Manual trigger> Enter manual trigger mode and give a trigger	No
ZERO OPEN	OP	--	<Correct floating admittance> Measure with measurement terminal kept open and then correct.	No
ZERO SHORT	SH	--	<Correct residual impedance> Measure with measurement terminal kept short-circuited and then correct.	No
CAL IBRATION	CA	--	<Calibration> Carry out gain correction.	No
STORE	SR	NR1 integer	<Store memory> Range: 1 to 9	No
RECALL	RC	NR1 integer	<Recall memory> Range: 0 to 9	No
RESUME	RM	NR1 integer	<Resume function> Range: 0 = OFF 1 = ON	Yes
INITIALIZE	IN	--	<Initialize> Initialize all measurement conditions.	No
BEEP	BE	NR1 integer	<Beep> Issue a beep according to the result of main parameter judgment during bin action. Range: 0 = OFF 1 = ON for BIN1 to BIN20 2 = ON for BIN A NG 3 = ON for all cases	Yes
STROBE	SO	NR3 exponential form	<Strobe signal length> (This is valid only for the ZM2354. For the ZM2353, set 1 ms (default value) to prevent slowing of measurement speed). Range: 1E – 3 to 19.999 [s] Resolution: 1m [s]	Yes
HANDLER LOGIC	HL	NR1 integer	<Handler signal polarity> (Valid for the ZM2354 only.) Range: 0 = LOW active 1 = HIGH active	Yes
CABLE	CB	NR1 integer	<Measurement cable length> Range: 0 to 4 [m] Resolution: 1 [m] If 3 is specified for setting, then 4m.	Yes

Parameter name or function	Program message		Action and setting range	Query
	Header	Parameter		
HEADER	HD	NR1 integer	<Header output> Range: 0 = Disabled (will not output) 1 = Enabled (will output)	Yes
SERVICE REQUEST	RQ	NR1 integer	<Service request> Specify whether or not to output SRQ. Range: 0 = Disabled (will not output) 1 = Enabled (will output)	Yes

Query message

Query message

Parameter name or function	Query message header	Output format, contents of query		Setting
		Header	Parameter	
DISPLAY A	?DA	DA	<Indication of main parameter> Format:NR1 (integer) Range: 1 = L 5 = AUTO L 2 = C 6 = AUTO C 3 = R 7 = AUTO R 4 =|Z| 8 = AUTO |Z|	Yes
DISPLAY B	?DB	DB	<Indication of sub parameter> Format:NR1 (integer) Range: ☞ See "Setting message".	Yes
DELTA/BIN	?DE	DE	<Indication of deviation and bin> Format:NR1 (integer) Range: ☞ See "Setting message".	Yes
DISPLAY BIN MODE	?DP	DP	<Indication during bin action> Format:NR1 (integer) Range: ☞ See "Setting message".	Yes
CIRCUIT	?CK	CK	<Equivalent circuit> Format:NR1 (integer) Range: 1 = SER 3 = AUTO SER 2 = PRL 4 = AUTO PRL	Yes
REFERENCE	?RF	RF	<Reference value for indication of deviation> Format: NR3 (exponential formal) Range: 0.0000E + 00 and ±(0.0001E – 12 to 19999.E + 06) Resolution: 4-1/2 digits, when not restrained by characteristic	Yes

Parameter name or function	Query message header	Output format, contents of query		Setting
		Header	Parameter	
BIN A	?BN	BN	<Main parameter comparator> Format: m1, m2, m3 m1 = Bin number (BIN) m2 = Lower limit (LOWER) m3 = Upper limit (UPPER) Data will be output continuously for 20 bins from Bin 1 to Bin 20, in this order, with a terminator put between a bin and next bin. Form: m1: NR1 (integer) m2, m3: NR3 (exponential form) Range: m1 = 1 to 20 m2, m3 = 0.0000E+00 and ±(0.0001E – 12 to 19999.E + 06)	Yes
BIN B	?BB	BB	<Sub parameter comparator> Format: m1, m2 m1 = Lower limit (LOWER) m2 = Upper limit (UPPER) Form: m1, m2: NR3 (exponential form) Range: 0.0000E + 00 and ±(0.0001E – 12 to 19999.E + 06)	Yes
MEASUREMENT DATA	?DT	DT	<Measurement data> Format: DISPLAY A, DISPLAY B Form and range: depend on parameter ☞ See "Reading measurement data".	No
	?PA	PA	<Display A high-resolution data> Form: NR3 (exponential form) Range: ± 9.999999999E + 34 Resolution: 10 digits for mantissa	No
	?PB	PB	<Display B high-resolution data> Form: NR3 (exponential form) Range: ± 9.999999999E + 34 Resolution: 10 digits for mantissa	No
	?PZ	PZ	<Rx and Xz high-resolution data> Form: NR3 (exponential form) Range: ± 9.999999999E + 34 Resolution: 10 digits for mantissa	No

Parameter name or function	Query message header	Output format, contents of query		Setting
		Header	Parameter	
COMPARATER	?CM	CM	<Result of comparator judgment> Format: m1, m2 m1 = Result of main parameter judgment m2 = Result of sub parameter judgment Form: m1, m2: NR1 (integer) Range: m1 = 0(A NG) and 1 to 20 (Bin number) m2 = 0(B NG) and 1(B OK)	No
FREQUENCY	?FR	FR	<Frequency> Form: NR3 (exponential form) Range: ☞ See "Setting message".	Yes
LEVEL	?LV	LV	<Measurement signal level> Form: NR3 (exponential form) Range: ☞ See "Setting message".	Yes
RANGE	?RN	RN	<Range> Form: NR1 (integer) Range: 1 = MAN range 1 to 6 = MAN range 6 7 = AUTO range 1 to 12 = AUTO range 6	Yes
SPEED	?SP	SP	<Measuring speed> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
DELAY	?DL	DL	<Delay time> Form: NR2 (floating point) Range: 0.00 to 199.99 [s] Resolution: 0.01 [s] fixed point	Yes
BIAS OUTPUT ON/OFF	?BO	BO	<Bias output> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
BIAS SWITCH INT/EXT	?BS	BS	<Bias switch> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
BIAS INTERNAL LEVEL	?BI	BI	<Internal bias level> Form: NR3 (exponential form) Range: ☞ See "Setting message".	Yes

Parameter name or function	Query message header	Output format, contents of query		Setting
		Header	Parameter	
TRIG MODE	?TR	TR	<Trigger mode> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
RESUME	?RM	RM	<Resume function> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
BEEP	?BE	BE	<Beep> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
STORE	?SO	SO	<Strobe signal length> Form: NR3 (integer) Range: ☞ See "Setting message".	Yes
HANDLER LOGIC	?HL	HL	<Handler signal polarity> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
CABLE	?CB	CB	<Measurement cable length> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
HEADER	?HD	HD	<Header output> Form: NR1 (integer) Range: ☞ See "Setting message".	Yes
SERVICE REQUEST	?RQ	RQ	<Service request output> Form: NR1 (integer) Range: ☞ See "Setting message".	No
STATUS BYTE	?ST	ST	<Status byte> Form: NR1 (integer) Range: 0 to 127 Data will be converted into a decimal number for outputting.	No

To read measurement data

Request for measurement data

Measurement data can be read by the following two methods.

- Use a query message of "?DT" for request.
- Use a setting message "TG" or a GET interface message to execute measurement.

"?DT"

Answering to this query message, the latest data will be prepared in the sending buffer. So, specify it as talker in order to read data.
Note that data output to this "?DT" will be canceled if another query message or a setting message "TG" is sent after sending the "?DT".

"TG" or GET interface message

If "TG" or a GET interface message is used to give a trigger, the ZM2353/ZM2354 will abort the going measurement and start a new measurement. When the measurement is complete, it will put the measurement data in the sending buffer.
If the user designates ZM2353/ZM2354 as a talker immediately after giving a trigger, then data will be output simultaneously with measurement completion (The listener will be kept waiting until the measurement has been completed).
Note that data output due to "TG" or GET will be canceled if another program code is sent after sending the "TG" or GET.

"?PA", "?PB" and "?PZ"

The data that "?DT" can read is the same value as shown on the panel. If the user wants to get data with higher resolution, use a special query message such as "?PA" prepared for asking high resolution data.

- "?PA": Inquires for the measurement on Display A
- "?PB": Inquires for the measurement on Display B
- "?PZ": Inquires for the value of R and X in the series equivalent circuit.

Standard resolution data format (query message ?DT)

This function outputs the measurements or settings shown on Displays A and B with a comma "," put in between for separation.

The format of response message for measurement data is as follows:

- L, C, R, |Z|, ESR, G and X

  Form: NR3 (indication by engineering floating point, characteristic is a multiple of 3)
  Resolution: 5 digits
  Range: 0.0000E – 12,
  "OF": "99999.E + 0.6"
  "UF": "–99999.E + 0.6"
  "OU": "88888.E + 06" (for L, C, R and |Z|)
  "0.0000.E + 00" (for ESR, G and X)
  Blank: "77777.E + 0.6"

- Q and D

  Form: NR2 (indication by floating point)
  Resolution: 5 digits
  Range: 0.0000, ±(0.0001 to 19999.)
  "OF": "99999."
  "UF": "–99999."
  "OU": "0.0000"
  Blank: "77777."

- θ

  Form: NR2 (indication by fixed point)
  Resolution: 0.01°
  Range: –180.00° to +179.99°
  "OU": " 0.00"
  Blank: "777.77"

- Δ

  Form: NR3 (indication by engineering floating point, characteristic is a multiple of 3)
  Resolution: 5 digits (max. 19999)
  Range: 0.0000E – 12, ±(0.0001E – 12 to 19999.E + 0.6)
  "OF": "99999.E + 0.6"
  "UF": "–99999.E + 0.6"
  "OU": "88888.E + 0.6"
  Blank: "77777.E + 0.6"

- Δ%

  Form: NR2 (indication by fixed point)

  Resolution: 0.01

  Range: ±199.99.

  "OF": "999.99"

  "UF": "–999.99"

  "OU": "888.88"

  Blank: "777.77"

- Indication of settings (FREQ, LEVEL, BIAS, RANGE and REF)

  Returns data in the same format as that for panel indication of each setting.

- Indication of BIN judgment (UPPER and LOWER)

  When comparator is functioning, if the indication mode ("DP" command) is upper and lower limit indication, the upper and lower limit values of the bin of final comparison judgment will be returned as the measurement data.

  Form: NR3 (indication by engineering floating point, characteristic is a multiple of 3)

  Resolution: 4-1/2 digits

  Range: 0.0000E – 12, ±(0.000E – 12 to 19999.E + 0.6)

  Blank: "77777.E + 0.6"

  "A_ng": "99999.E + 06"

High-resolution data format (query message ?PA, ?PB, and ?PZ)

- Display A (response to ?PA)

  "[PA] Value on Display A Delimiter"

  Form: NR3 (exponential indication)

  Resolution: 10 digits

  Range: ±9.999999999E ±34

  Even if the panel shows an indication of "OF" or "UF", an acceptable indication value can be obtained if it is within the above range.

  "OU": "8.888888888E + 34"

  Blank: "7.777777777E + 34"

- Display B (response to ?PB)

  "[PB] Value on Display B Delimiter"

  Form: NR3 (exponential indication)

  Resolution: 10 digits

  Range: ±9.999999999E ±34

  Even if the panel shows an indication of "OF" or "UF", an acceptable indication value can be obtained if it is within the above range.

  "OU": "8.888888888E + 34"

  Blank: "7.777777777E + 34"

- Rs and Xs data (response to ?PZ)

  "[PZ] Value of Rs Value of Xs Delimiter"

  Form: NR3 (exponential indication)

  Resolution: 10 digits

  Range: ±9.999999999E ±34

  Even if the panel shows an indication of "OF" or "UF", an acceptable indication value can be obtained if it is within the above range.

  "OU": "8.888888888E + 34"

  Blank: "7.777777777E + 34

Bin judgment result data format (query message ?CM)

When the comparator is functioning, the result of bin judgment shown on Displays A and B will be output with a comma "," put in between for separation.

"[CM] Display A judgment result, Display B judgment result Terminator"

- Display A judgment result

  Form: NR1 (integer)

  Range: 0 to 20 (0 means A NG.)

  "OU": "88"

  Blank: "77"

- Display B judgment result

  Form: NR1 (integer)

  Range: 0 to 1 (0 means B NG and 1 means B OK.)

  "OU": "88"

  Blank: "77"

Response to interface messages

Response to an interface message is shown below.

Interface message	Response to message
IFC (Interface clear)	Initializes the GPIB interface. (Releasing listener and talker, etc.)
DCL (Device clear) or SDC (Selected device clear)	Fixes the error. Clears the sending and receiving buffers for GPIB. Aborts the SRQ sending (resets the status byte). Disables SRQ sending (equivalent to "RQ 0") Disables header output (equivalent to "HD 0") Aborts the measurement.
LLO (Local Lock Out)	Inactivates the Local button on the operation section.
GTL (Go to local)	Brings the system into a local state.
GTL (Group execute tring)	Starts measurement (the same as the trigger by program code).

The use of interface message varies with the GPIB driver on the controller side.

☞ For further information, see the manual for the GPIB driver.

Sample Program

The following shows an example of a remote control that uses a GPIB interface.
A description is provided for the following examples that use Microsoft's Visual Basic and National Instruments' GPIB interface.

Settings

- Frequency setting example

Query

- Example of query about voltage level setting
- Example of query about BIN setting

Query about measurement results

- Example using setup message "TG" and serial polling
  The "TG" message triggers the measurement to be started and serial polling is executed using the timer control at an interval. Once the completion of the measurement is confirmed via the results of serial polling, data is read.
- Example using GET command and serial polling
  The GET command triggers the measurement to be started and serial polling is executed using the timer control at an interval. Once the completion of the measurement is confirmed via the results of serial polling, data is read.
- Example using "TG" message and SRQ
  The "TG" message inputs a trigger, SRQ is used to confirm that measuring has been completed, then the data is read.
- Example using setup message "TG" only
  The "TG" command inputs a trigger, the ZM2353/ZM2354 is specified as the talker, and data is read once measurement has been completed.

In all of these examples, error checking has been omitted.
When creating an actual program, error processing and initialization steps should also be considered.

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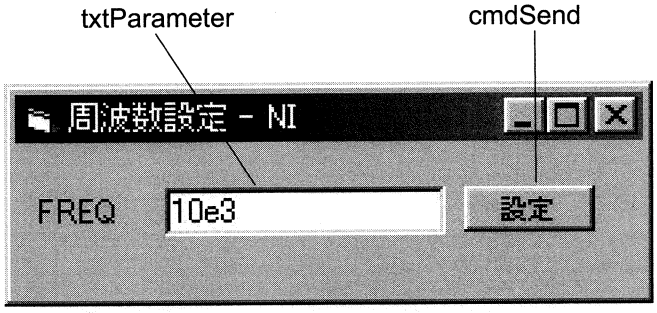
Settings

The following is a sample program that specifies frequency settings.
Click the Set button and set the value input in the FREQ text box is set as a frequency.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.
Click the Set button to set the contents of the FREQ text box as a parameter and to send the frequency setting message to the device.
In "Form_Unload", the device is set back to local mode.

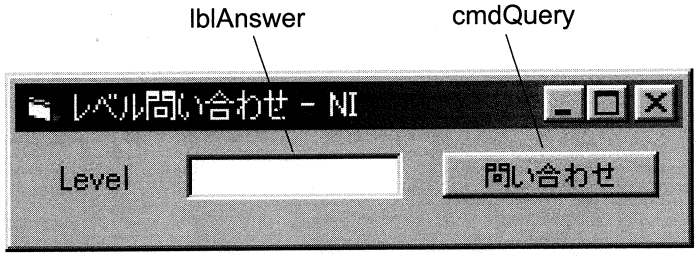


```
Const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, 0, Div        ' Open device
    ibclr Dev                               ' Device clear
End Sub

Private Sub Form_Unload(Cancel As Integer)
    ibloc Dev                               ' Return to local mode
End Sub

Private Sub cmdSend_Click()
    ibwrt Dev, "FR" + txtParameter          ' Set frequency
End Sub
```

Query (measurement voltage level)

This sample program queries and displays the measurement voltage level.
Click the Query button to display the measurement voltage level value on the label.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.
Click the Query button to query the measurement voltage level and to display the answer message on the label.
In "Form_Unload", the device is set back to local mode.



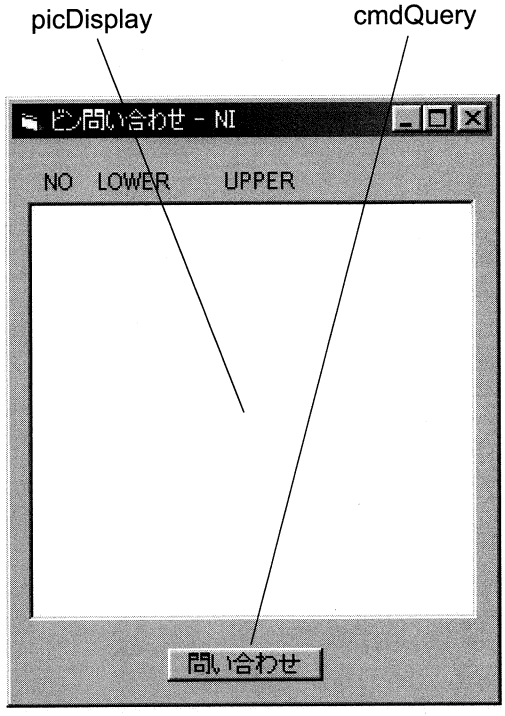
```
Const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, 0, Dev        ' Open device
    ibclr Dev                               ' Device clear
End Sub

Private Sub Form_Unload(Cancel As Integer)
    ibloc Dev                               ' Return to local mode
Ens Sub

Private Sub cmdQuery_Click()
    Dim r As String * 256
    ibwrt Dev, "?LV"                        ' Query measurement voltage level
    ibrd Dev, r                             ' Receive answer message
    lblAnswer = r                           ' Display answer message on label
End Sub
```

Query (bin setting)

This sample program queries and displays bin settings.
Click the Query button to view 20 bin settings in the picture box.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.
Click the Query button to query the bin settings. Answer messages are read for each message terminator and are displayed in the picture box.
The answer message includes all 20 bins in sequence from bin 1 to bin 20, divided by EOS characters.
In "Form_Unload", the device is set back to local mode.

In this example, the EOS characters must be coordinated between the talker and listener when receiving the answer message.
Afterward, a line feed (LF) character is set as the message terminator to be sent by the ZM2353/ZM2354.

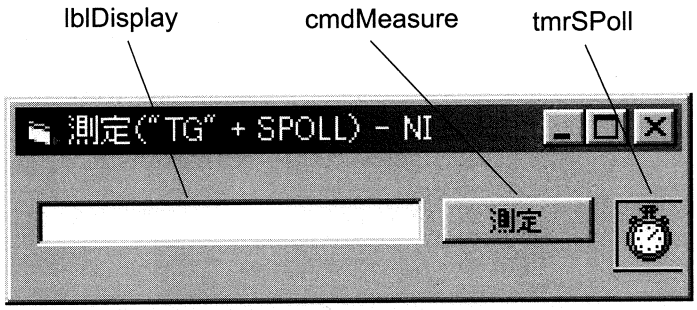


```
Const Adr As Integer = 2                    ' GPIB address
Const E0SCHR As Integer = &HA               ' EOS character (LF)
Const EOSTR As Integer = XEOS + REOS + EOSCHR
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, EOSTR, Dev    ' Open device
    ibclr Dev                               ' Device clear
End Sub

Private Sub Form_Unload(Cancel As Integer)
    Dim stat As Integer
    iblock Dev                              ' Return to local mode
End Sub

Private Sub cmdQuery_Click()
    Dim i As Integer
    Dim l As Integer
    Dim r As String * 256
    ibwrt Dev, "?BN"                        ' Query bin
    For i = 1 To 20
        ibrd Dev, r                         ' Receive answer message
        i = Instr(r, Chr(EOSCHR)) – 1       ' Get length of answer message
        picDisplay.Print Left(r, l)         ' Display answer message
    Next
End Sub
```

Measurement (TG and serial polling)

The following is a sample program that uses the "TG" setup message and serial polling.
Click the Measure button to display the measurement results on the label.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.
Click the Measure button to send the "TG" message and input a trigger, and the timer is set as valid.
In the timer processing, the status byte that is obtained by serial polling is referenced, and once the completion of measurement has been confirmed, the measurement result is received and displayed on the label.
In "Form_Unload", the device is set back to local mode.



```
Const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, 0, Dev        ' Open device
    ibclr Dev                               ' Device clear
    tmrSPoll.Enabled = False
    tmrSPoll.Interval = 500
End Sub

Private Sub Form_Unload(Cancel As Integer)
    tmrSPoll.Enabled = False
    ibloc Dev                               ' Return to local mode
End Sub

Private Sub cmdMeasure_Click()
    ibwrt Dev, "TG"                         ' Trigger input
    tmrSPoll.Enabled = True
End Sub

Private Sub tmrSPoll_Timer()
    Dim stb As Integer
    Dim r As String * 256
    ibrsp Dev, stb                          ' Serial polling
    If Not (stb & 16) Then                  ' Reference status byte
        ibrd Dev, r                         ' Receive measurement result
        lblDisplay = r                      ' Display received data
        tmrSPoll.Enabled = False
    End If
End Sub
```

Measurement (GET and serial polling)

The following is a sample program that uses the GET command and serial polling to perform measurements.

Click the Measure button to display the measurement results on the label.

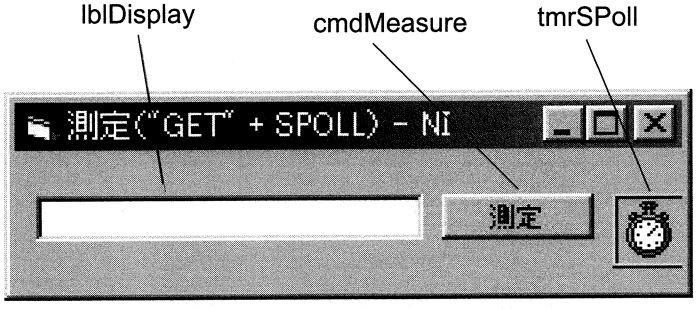
In "Form_Load", the required initialization is executed.

In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.

Click the Measure button to send the GET command and input a trigger, and the timer is set as valid.

In the timer processing, the status byte that is obtained by serial polling is referenced, and once the completion of measurement has been confirmed, receive the measurement result is received and displayed on the label.

In "Form_Unload", the device is set back to local mode.



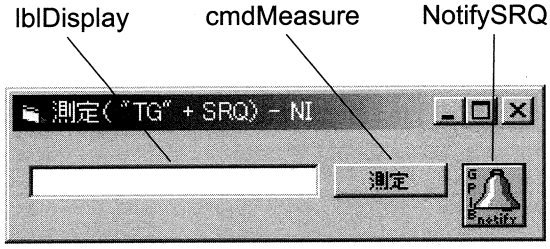
```
const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, 0, Dev        ' Open device
    ibclr Dev                               ' Device clear
    tmrSPoll.Enabled = False
    tmrSPoll.Interval = 500
End Sub

Private Sub Form_Unload(Cancel As Integer)
    tmrSPoll.Enabled = False
    ibloc Dev                               ' Return to local mode
End Sub

Private Sub cmdMeasure_Click()□
    ibtrg Dev                               ' Trigger input
    tmrSPoll.Enabled = True
End Sub

Private Sub tmrSPoll_Timer()
    Dim stb As Integer
    Dim r As String * 256
    ibrsp Dev, stb                          ' Serial polling
    If Not (stb & 16) Then                  ' Reference status byte
        ibrd Dev, r                         ' Receive measurement result
        lblDisplay = r                      ' Display received data
        tmrSPoll.Enabled = False
    End If
End Sub
```

Measurement (TG and SRQ)

The following is a sample program that uses the "TG" message and SRQ to perform measurements.
Click the Measure button to display the measurement results on the label.

In the following example, GPIB Notify OLE control is used to monitor the SRQ and trigger events.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS.
Click the Measure button to send the "TG" message and input a trigger.
When an SRQ occurs, the status byte obtained by serial polling is referenced, and once the completion of measurement has been confirmed, the measurement result is received and displayed on the label.
In "Form_Unload", the device is set back to local mode.



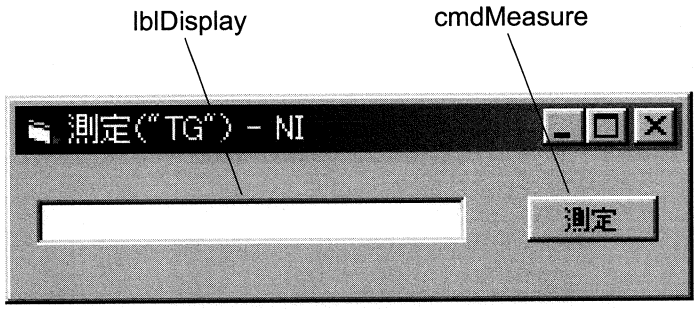
```
Const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    Dim stat As Integer
    ibdev 0, Adr, 0, T10s, 1, 0, Dev        ' Open device
    ibclr Dev                               ' Device clear
    ibwrt Dev, "RQ.1"                       ' Enable SRQ
    NotifySRQ.SetupNotify Dev, RQS          ' Set up SRQ monitoring
End Sub

Private Sub Form_Unload(Cancel As Integer)
    ibloc Dev                               ' Return to local mode
End Sub

Private Sub cmdMeasure_Click()
    ibwrt Dev, "TG"                         ' Trigger input
End Sub

Private Sub NotifySRQ_Notify(ByVal LocalUd As Long, ByVal Locallbsta As Long, ByVal
Locallberr As Long, ByVal Locallbcntl As Long, RearmMask As Long)
    Dim stb As Integer
    Dim r As String * 256
    If (Locallbsta & RQS) Then              ' Reference status byte
        ibrsp Dev, stb                      ' Serial polling
        If (stb & 16) Then
            ibrd Dev, r                     ' Receive measurement result
            lblDisplay = r                  ' Display received data
        End If
    End If
    RearmMask = RQS                         ' Reset SRQ monitoring
End Sub
```

Measurement (TG only)

The following is a sample program that uses only the "TG" setup message.
Click the Measure button to display the measurement results on the label.

In "Form_Load", the required initialization is executed.
In this case, the device descriptor (Dev) is open, with a 10-second timeout period, GPIB address 2, valid EOI, and without any EOS. Be sure to set a timeout value that is large enough to prevent a timeout from occurring before measurement has been completed.
After you click the Measure button to input a trigger, the measurement result is received and displayed on the label.
In "Form_Unload", the device is set back to local mode.

In this example, the software is not able to operate in any way until the measurement has been completed.
To avoid waiting for the ZM2353/ZM2354 only or to perform other processing while waiting for completion of measurement, use polling or SRQ to reference measurement examples.



```
Const Adr As Integer = 2                    ' GPIB address
Dim Dev As Integer

Private Sub Form_Load()
    ibdev 0, Adr, 0, T10s, 1, 0, Dev        ' Open device
    ibclr Dev                               ' Device clear
End Sub

Private Sub Form_Unload(Cancel As Integer)
    ibloc Dev                               ' Return to local mode
End Sub

Private Sub cmdMeasure_Click()
    Dim r As String * 256
    ibwrt Dev, "TG"                         ' Trigger input
    ibrd Dev, r                             ' Receive measurement result
    lblDisplay = r                          ' Display received data
End Sub
```