KENWOOD

PWR series

INSTRUCTION MANUAL
(For Remote Control Operation)

KENWOOD CORPORATION

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1. OUTLINE

The PWR Series is a fully remote-controllable, multiple-output DC constant-voltage/current power supply. The series incorporates a LISTENER function, which allows remote control of all the functions of the PW Series, and a TALKER function, which allows read-back of all preset conditions and output current/voltage values.
Equipped with a computer-controlled measurement system and numerous programmable functions, the PWR Series is a versatile machine which is useful for a wide range of applications.

Guidelines on Instruction Manual Usage

The PWR series instruction manual comes in two sets, one for remote control and the other for the power supply. This instruction manual is for the former. Refer to the other manual for the power supply.

2. FEATURES

■ Expansion to System-Level Power Supply via GP-IB Control

The PWR can be combined with the GP-IB adapter (GP-620, sold separately) to enable use with automation measurement systems, and is equipped with a LISTENER/TALKER function that enables control of all the unit's functions and enables read-back of all output voltage/current values. Using ID recognition, allows construction of high-security systems capable of controlling up to four units.

■ Expansion to Programmable Power Supply via Computer Control

The PWR can be connected to an external computer to enable functioning as a programmable power supply, for use in simulation and other experiments. A system can easily by constructed to enable control of all the machine's functions, as well as read-back of all output voltage/current values.

■ MASTER Mode Operation

With incorporation of the built-in ONE CONTROL function, centralized control of multiple units is possible. One unit of a given model can be used as the MASTER to control (under the same conditions) all the functions of up to four SLAVE units of the same model.

■ External Remote Control

The PWR can be used in combination with the RT-63 Remote controller (sold separately) to enable remote control of up to four units for functions such as switching of preset values (output voltage) and ON/OFF switching of output voltage and output protect. In addition, remote control can be effected via the RT- 63 using external contact signals and logic signals.

3. SPECIFICATIONS

Data transmission speed	9600 bit/sec, error within 5%	
Data code structure	start bit data bit parity bit stop bit	1 bit 7 bit 1 bit 1 bit
Parity method	even parity	
Max. length of control cord	1.5 m	
Max. number of controllable machines	4 units	
Signal method	single-pass NRZ	0:5 V 1:0 V

4. PRECAUTIONS FOR USE

Please keep the following in mind when reading this manual. This manual was written for use with all four models of the PWR Series. However, since there may be commands that do not apply to the particular PWR Series model you are using, check the entry to the right of each command to confirm for which models the command is applicable.

Model name	Abbreviation
PWR 18-2	(18-2)
PWR 36-1	(36-1)
PWR 18-1T	(18-T)
PWR 18-1.8Q	(18-Q)

* When connecting the machine to control units such as computers, or when interconnecting multiple units of the machine with each other, use only the connecting cords provided.
* Since the temperature of the heat sink can become quite high depending upon the machine's state of operation, do not allow the provided connecting cords to come in contact with the heat sink.
* When connecting multiple machines, erroneous connection of the REMOTE IN terminal with the machine's IN terminal can be a cause of machine breakdown. Be sure to connect only IN and OUT terminals to each other.

* When controlling this unit with a high-speed computer, etc., the waiting time between electric voltage/current should be about 50 ms to transmit them successively. Without the waiting time, commands may not be carried out (commands may drop).

EXPLANATION OF TERMINOLOGY

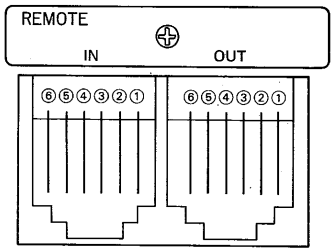
○ **MASTER Unit:** A PWR Series unit used as the controller to control other PWR Series units.
- The PWR unit that carries the ADDRESS NO. ''0'' during MASTER mode operation.
- The terminal device used in RS-232 control.
- Controlling GP-IB
  GP-620 (GP-IB adapter)
- Remote Control
  RT-63 (Remote Controller)

○ **SLAVE Unit:** A PWR Series unit that is controlled by a MASTER unit.
These units carry ADDRESS NO.'s other than ''0''.

○ **REMOTE State:** The state in which a SLAVE unit cannot be operated by the usual operating keys because it is being controlled by a MASTER unit.

○ **LOCAL State:** The state in which a PWR unit can be controlled via its own control keys.

EXPLANATION OF REMOTE CONNECTOR



"IN" Side

① FRAME GND: Connected to the PWR unit's frame and to the GND terminal.
② TXD: The PWR's signal transmission terminal.
③ PW-BUS: The signal reception/transmission terminal for communication between PWR units.
④ Signal GND: The ground for RXD, TXD, PW-BUS, and +5 V.
⑤ RXD: The PWR's signal reception terminal.
⑥ +5 V: Generated inside the PWR unit. The output current is 200 mA max.

"OUT" Side

① FRAME GND
② ————
③ PW-BUS
④ Signal GND
⑤ ————
⑥ ————

- Terminals 1, 3 and 4 of the REMOTE connector are connected internally (inside the PWR unit) to OUT terminals 1, 3 and 4, respectively.
- Use the provided cords for connection to the REMOTE connector.

When switching from the remote control mode to the local mode, any setting made in the former becomes carried on to the latter. However, any setting made prior to switching to the remote control mode becomes void.

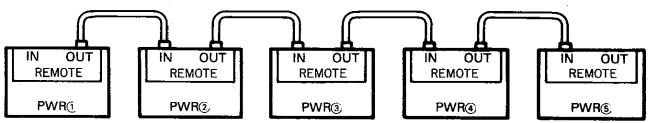
* Neither PWR18-2 or PWR36-1 are equipped with the DELAY function. However, if these two units are used as slaves under the control of signals from some master unit (PWR with DELAY function or computer) it becomes possible to set the delay time through such master unit.
* Take note that when switching from the remote control mode to the local mode, any DELAY time setting made in the former becomes carried on to the latter.

5. DIRECTIONS FOR USE

1. MASTER Operation

During MASTER Operation, the MASTER unit operates in TALK ONLY mode, and the SLAVE units operate in LISTEN ONLY mode.
Therefore, there should be no intermixing of machine types, and machines of all the same model should be used.

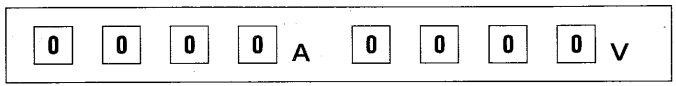
① Interconnecting machines with the connecting cords.
Turn the power switches of all the machines to "OFF" and, using the connecting cords provided, connect the machines as shown below. Be sure to connect only IN terminals to OUT terminals, and never connect IN to IN.



Master "0" Slave "1" Slave "2" Slave "3" Slave "4"

Up to 5 machines of the same model can be connected. If more than 5 machines are connected, control may become impossible to achieve.

② Designating the MASTER Unit.
1) Turn the POWER switch of PWR #1 to "ON" while depressing the A key. When the V.A display appears as shown in the diagram below, release the A key.



2) After POWER ON, the display will continue to appear as above for about 3 seconds, after which it will appear as shown below.

The ADDRESS NO. ordinarily will have an initial value of "1", unless it is preset previously to a different value. In this case, the initial value of the ADDRESS NO. will be the preset value.

3) The ADDRESS NO. of the MASTER unit is set to "0" via rotary encoder. The ADDRESS NO. is decreased by rotating the encoder to the left and increased by rotating to the right. The ADDRESS NO. can be set fromto any value from "0" to "26".

When the ADDRESS NO. is set to "0", the KEY LOCK LED will light up green.

4) When the A key is depressed, the unit will leave the ADDRESS setting mode and return to the state described in ①, which occurs before the POWER is turned to "OFF", and any of the settings can be changed. The KEY LOCK LED lights up green, indicating that this unit is the MASTER unit.

> The MASTER unit can be any one of the units connected by the connecting cords, but NEVER ASSIGN MORE THAN ONE UNIT AS THE MASTER UNIT as this can lead to operation failure.

③ Designating the SLAVE units.

1) As in the procedure for designating the MASTER unit, when designating a SLAVE unit, turn the POWER switch to "ON" while depressing the A key, and set the ADDRESS NO. using the rotary encoder. When setting SLAVE unit addresses, use the numbers from 1 to 26, but do not use "0".

2) When the A key is depressed, the unit will return to the state described in ①, which occurs before the POWER is turned to "OFF".
3) Set the ADDRESS NO.'s of the other SLAVE units in the same way.

> The ADDRESS NO. of each slave unit can be selected from among the numbers 1 through 26. However, to avoid confusion, assign a unique ADDRESS NO. to each of the slave units.

④ Initial setting of slave unit

Set all the settings of all the SLAVE units to match those of the MASTER unit.

> Information on changed settings will be sent to the SLAVE units via the MASTER unit. Operation failure may therefore result if the settings of the MASTER and SLAVES do not match.

⑤ **Setting remote condition**

Operate the MASTER unit to achieve the desired settings. When information on changed settings is sent to the SLAVE units via the MASTER unit, all of the SLAVE units go into the REMOTE mode and the following occurs:

- The KEY LOCK LED lights up orange.
- The V/A and DELAY LEDs go off.
- The settings of all the SLAVE units change to match those of the MASTER unit.

If the MASTER unit is used to attempt remote of a SLAVE unit while the SLAVE unit is in the Address Set mode, the SLAVE unit will cease to operate and will no longer accept input from its control keys. Avoid using the setup in this way. However, if this condition should result, turn off the SLAVE unit's power switch and turn the unit ON again while pressing the VARIABLE key. The SLAVE unit will return to its initial state.

⑥ **Switch a SLAVE unit from the remote mode to the LOCAL mode.**

When the KEY LOCK LED of a SLAVE unit is lit up in green, the unit is in the REMOTE mode. In this mode, if the key lock key is pressed, the KEY LOCK LED goes off and the unit switches from the REMOTE mode to the LOCAL mode. The settings of the unit can then be changed using the controls on that unit.

If the MASTER unit is operating at any time after switching a SLAVE unit from the REMOTE to the LOCAL mode, the SLAVE unit will return to the REMOTE mode.

⑦ **If the VARIABLE key is pressed while the MEMORY LED is lit, the VARIABLE LED will blink for about 3 seconds.**

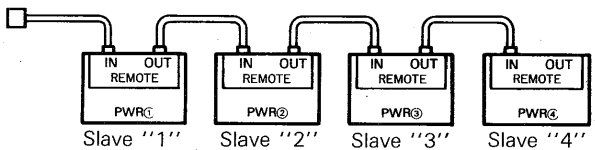
While the VARIABLE LED is blinking, the set ADDRESS NO. will be displayed on the V/A display LED. The ADDRESS NO. setting cannot be changed at this time.

2. Computer Control

RS-232C Control

① **Connect the machines using the provided connecting cords.**

Turn the POWER switches of all the units to "OFF" and connect the units as shown in the diagram below.

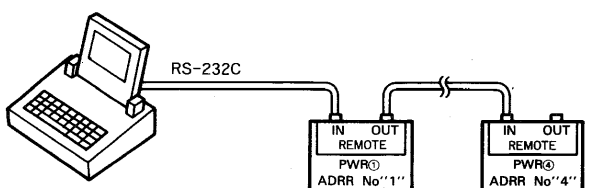


Unlike in MASTER operation, machines of different types can be connected. However, the maximum number of machines connected should be limited to four.

② Set the ADDRESS NO.'s of the SLAVE units.
Set the ADDRESS NO.'s of the slave units in the same way as for MASTER operation.

Each of the ADDRESS NO.'s should be set to a value from "1" to "26". Remember that operation failure will result if more than two machines have the same ADDRESS NO., or if any of the ADDRESS NO.'s is set to "0".

③ Connect the PWR power supply to the PC or other terminal device (MASTER unit).



Terminal Device
(Computer etc.)

1) Connect the remote controller (PWR1 remote connector IN) with the master unit, using the connecting cord which comes included with the PWR series power supply unit.
Use the optional modular/D-SUB conversion connector (TA-60) for the RS-232C connector on the master unit.
Refer to the diagram shown below for the connection between the RS-232C connector and PWR1 remote connector IN.

Connection diagram of TA-60

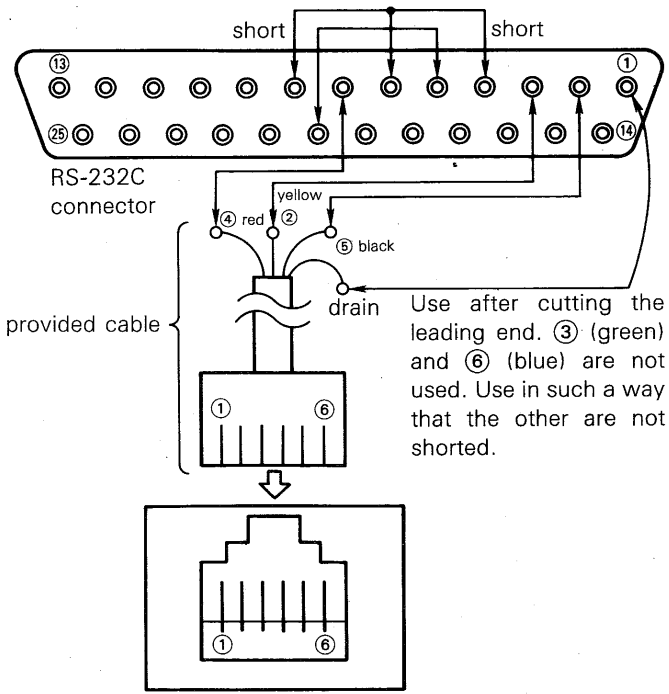
Terminal Device RS232-C connector		PWR REMOTE IN connector
① MASTER unit frame GND	↔	① PWR frame GND
② BA	↔	⑤ RXD
③ BB	↔	② TXD
⑦ MASTER unit signal GND	↔	④ PWR signal GND
		③ NC
		⑥ NC

④ CA ⟵
⑥ CC ⟵
⑧ CF ⟵

⑤ CB ⟵
⑳ CD ⟵

When connecting the MASTER unit to the PWR, be sure that the POWER switches of both units are set to "OFF".

2) Connect the RS-232C connector as shown below.



Use IN remote terminals ②~⑥ and OUT terminals ③, ④ floated from the remote IN ① and OUT ① terminals (from the frame GND terminals on the master and Slave units). Without this procedure, the PWR may not function correctly.

④ Setting the remote condition.

Send a control signal from the terminal device (MASTER unit) to the PWR.

When an information message is sent from the MASTER unit to a PWR unit, the PWR unit receiving the message will switch from the LOCAL mode to the REMOTE mode, and the KEY LOCK LED will light up orange.

PWR units that do not receive information messages from the MASTER unit will remain in the LOCAL mode, and their KEY LOCK LEDs will remain unchanged. For details, please see the information message formats described in the next section.

When a SLAVE unit in the LOCAL mode receives both an "LC1" and "LL1" command from the MASTER unit as an information message, the SLAVE unit will not switch to the REMOTE mode, but will remain in the LOCAL mode.

⑤ Switch from the REMOTE mode to the LOCAL mode

If the KEY LOCK key is pressed while the PWR is in the REMOTE mode and the KEY LOCK LED is lit up orange, the PWR will switch from the REMOTE mode to the LOCAL mode. Furthermore, the PWR can be changed from the REMOTE to the LOCAL mode via the terminal device (MASTER unit). However, when the PWR is in the LOCAL LOCKOUT mode, it cannot be switched from the REMOTE to the LOCAL mode. For details, please see the information message formats described in the next section.

> After a SLAVE unit in the LOCAL mode receives an "LL1" command from the MASTER unit as an information message, LOCAL/REMOTE switching of the SLAVE unit cannot be achieved using its KEY LOCK key if the SLAVE is being used in the REMOTE mode.

3. GP-IB Control

Using the GP-IB adapter (GP-620: optional) enables GP-IB control of 4 PWR (slave) units by 1 GP-620 (master) unit.
All PWR functions can be controlled. A listener/talker function by which the output voltage and electric current can be read out is included.
Refer to the GP-620 operation manual for details.

4. Remote Control

Using the remote controller (RT-63: optional) enables simultaneous remote control of up to 4 PWR (slave) units. This includes their output, ON/OFF of output protect, preset (output value), and switching.
Remote control by external source contact signals and logic signals is also enabled via the RT-63.
Refer to RT-63 instruction manual for details.

6. INFORMATION MESSAGE FORMATS

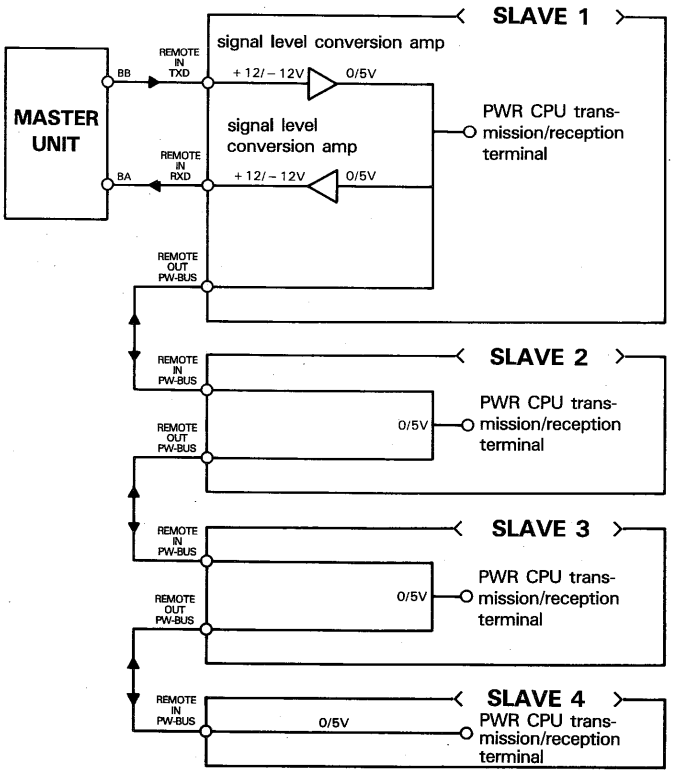
Precautions Regarding RS-232C Controlled PWR Transmission/Reception Pathways

With the PWR, one unit (MASTER unit) can be used to control up to 4 other units. When the MASTER unit is used to control only one other unit, it is connected to the other unit by two signal pathways, one for reception and one for transmission. When the MASTER unit is used to control from 2-4 other units, the unit connected directly to the MASTER unit (the "first" unit) is connected by two pathways as described above. The second PWR and any others are connected to the first PWR by a common reception/transmission pathway that passes via the first machine's signal level conversion amp.

Therefore, when there is an SRQ reply from a PWR to the MASTER unit during message transmission from the MASTER unit to the PWR, or when there are simultaneous SRQ replies from multiple PWRs to the MASTER unit, signal collision will occur on each of the transmission paths and the PWRs will not operate. To prevent this type of operation failure, manage the PWR reception/transmission pathways via the CSMA/CD (carrier sence multiple accese/collision detection) method.

Please refer to Chapter for a reference program which uses the CSMA/CD Method (Carrier Sense Multiple Access/Collision Detection Method).

Block Diagram of PWR Reception/Transmission Pathways



The ◄ symbol denotes the flow of signals.

7. TRANSMISSION CODES

PWR transmission and reception is handles using 7-unit ASCII codes. PLease refer to the following ASCII code chart.

	b7 b6 b5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4~b1		0	1	2	3	4	5	6	7
0000	0	NUL	TC7(DLE)	SP	0	@	P		p
0001	1	TC1(SOH)	DC1	!	1	A	Q	a	q
0010	2	TC2(STX)	DC2	"	2	B	R	b	r
0011	3	TC3(ETX)	DC3	#	3	C	S	c	s
0100	4	TC4(EOT)	DC4	$	4	D	T	d	t
0101	5	TC5(ENQ)	TC8(NAK)	%	5	E	U	e	u
0110	6	TC6(ACK)	TC9(SYN)	&	6	F	V	f	v
0111	7	BEL	TC10(ETB)	'	7	G	W	g	w
1000	8	FEO(BS)	CAN	(	8	H	X	h	x
1001	9	FE1(HT)	EM	)	9	I	Y	i	y
1010	A	FE2(LF)	SUB	*	:	J	Z	j	z
1011	B	FE3(VT)	ESC	+	;	K	[	k	(
1100	C	FE4(FF)	IS4(FS)	,	<	L	\	l	|
1101	D	FE5(CR)	IS3(GS)	-	=	M	]	m	)
1110	E	SO	IS2(RS)	.	>	N	^	n	~
1111	F	SI	IS1(US)	/	?	O	_	o	DEL

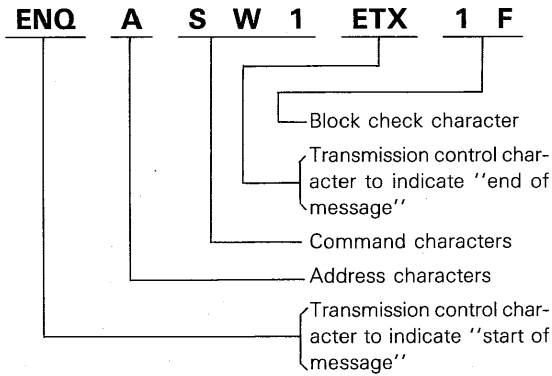
8. PWR TRANSMISSION/RECEPTION Methods

1) Information messages sent from the MASTER unit to a SLAVE unit should begin with a transmission control character that indicates the start of the message, followed by an address character, a command character, a transmission control character that indicates the end of the message and, finally, a block check character.
Multiple command characters can be sent, and a comma (,) is used as the delimiter between commands. An information message sent from the MASTER unit to a PWR can have a maximum length of 255 characters, including the spaces between characters.

* Broadcast Mode
The MASTER unit can send information messages for all the SLAVE units. Address characters use the number symbol (#).

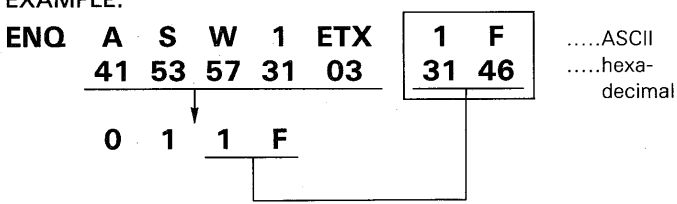
Do not transmit "ST" command information data in the "Broadcast" mode as this results in collision of signals (garbled signals).

EXAMPLE: To sent OUTPUT information to the SLAVE unit having ADDRESS NO. "1":

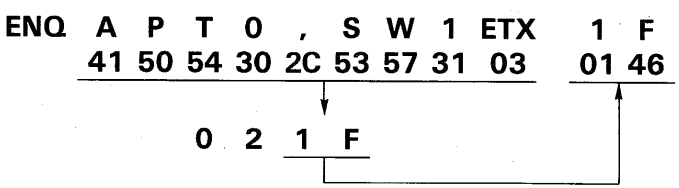


Explanation of Block Check Character

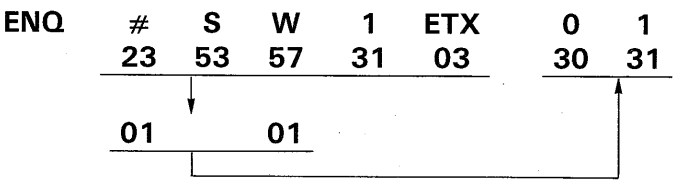
The block check character, which consists of 2 bytes, is computed from the bottom 8 bits of the binary sum obtained by adding together the values of the ASCII codes for the 7 bits from the address character to the "end of message" character. The hexadecimal representation of this binary sum is converted to ASCII to obtain the block check character.
EXAMPLE:



Now, turn the OUTPUT PROTECT of the ADDRESS NO. 1 unit to "OFF" and the OUTPUT to "ON".



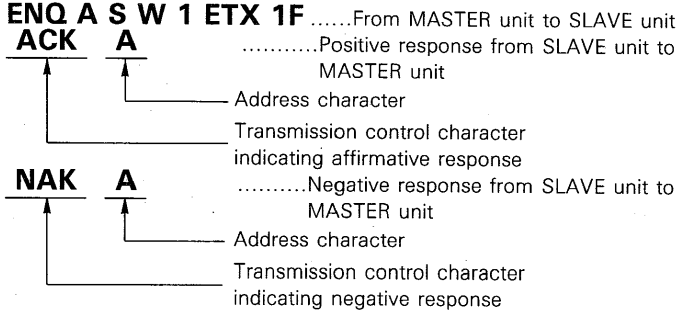
EXAMPLE: All slave units (when sending information to turn the #2 OUTPUT to "ON").



SLAVE units will ignore any information messages that contain grammatical or range errors. Spaces entered within the command characters are treated as grammatical errors. When an information messages exceeds the rated voltage, current, or delay time of a SLAVE unit, the SLAVE unit will be set to either the maximum or minimum rated value. When information messages are sent form the MASTER unit to a SLAVE unit, be sure that no message is sent from the SLAVE unit to the MASTER unit (SLAVE information message).

2) When an information message is sent from the MASTER unit to a SLAVE unit, the SLAVE unit will answer by sending either an affirmative or negative signal to the MASTER unit. If the SLAVE unit has received the information address accurately, the SLAVE unit will transmit to the MASTER unit a transmission control character indicating an affirmative response, and an address character. If the SLAVE unit has not received the information address accurately, the SLAVE unit will transmit to the MASTER unit a transmission control character indicating a negative response, and an address character.

EXAMPLE:



The affirmative or negative response sent from a SLAVE unit to the MASTER unit is an information message by which the SALVE unit indicates whether or not it has accurately received the information message sent to it by the MASTER unit. Therefore, even if an information message

sent from MASTER to SLAVE contains grammatical or range errors, the SLAVE unit will send an affirmative response to the MASTER as long as the relationship between the block check character and the other characters is correct. Likewise, even if all the characters in the information message are accurate, the SLAVE unit will send a negative response to the MASTER unit if the relationship between the block check character and the other characters is not correct.

Only in the broadcast mode, however, a SLAVE unit will not send a positive or affirmative response to the MASTER after receiving an information message.

When an information message has been sent from MASTER to SLAVE, there is no affirmative or negative response sent from the SLAVE to the MASTER. When sending a second information message from MASTER to SLAVE, wait until at least 500 ms after transmission of the first message has been completed. If not, signal collision may occur along the PWR transmission pathway.

3) After a SLAVE unit has received an information message from the MASTER unit and transmitted an affirmative response to the MASTER unit, the SALVE unit executes the instructions contained in the information message.

In the case where the SLAVE unit transmits a negative response to the MASTER unit, the SLAVE unit does not do anything, but continues to operate in the same state as before the information message was received.
However, even if the SLAVE unit has transmitted an affirmative response, if there are grammatical or range errors within the information message, the SALVE unit will ignore the message and will continue to operate in the same state as before the message was received.
When sending a multicommand (multiple command) via information message, if one of the command characters in the multicommand contains a grammatical error, the SLAVE unit will ignore that one command character. However, the SLAVE unit will execute the instructions contained in the other command characters.

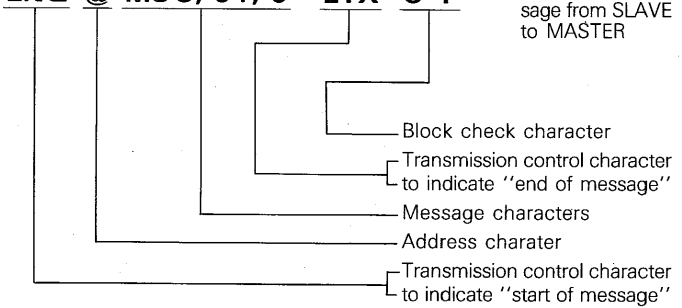
4) When the MASTER unit sends a SLAVE unit an information message requesting the TALK (status output) function, and the SLAVE unit answers with an affirmative response, the SLAVE unit then sends the MASTER unit an information message consisting of: a transmission control character to indicate the start of the message, an address character, a message character, a transmission control character to indicate the end of the message and, finally, a block check character.

EXAMPLE: What type of PWR Series model is the unit which is being controlled under the ADDRESS NO. "1" ?

ENQ A S T 3 ETX 1 E ···· From MASTER unit to SLAVE unit

ACK A ···· Affirmative response from SLAVE unit to MASTER unit

ENQ @ MS 3, 01, 0 ETX C F .... Information message from SLAVE to MASTER



The contents of the message sent from the SLAVE to the MASTER indicate that the SLAVE unit being controlled under ADDRESS NO. 1 is a PWR18-1. 8Q.

When sending a MASTER-to-SLAVE information message containing instructions for the TALK function, do so in a {"no service requests allowed" state} as signal collision may otherwise occur on the PWR reception/transmission pathway.

5) After transmission of a SLAVE-to-MASTER information message has finished, send an affirmative or negative response from the MASTER unit to the SLAVE within 500 ms.

EXAMPLE:

{ ENQ @ MS 3, 01, 0 ETX CF····· From SLAVE to MASTER
{ ACK @ ····· From MASTER to SLAVE

If a negative response is sent, the SLAVE unit will send its information message to the MASTER once more.

EXAMPLE:

{ ENQ @ MS 3, 01, 0 ETX CF····· From SLAVE to MASTER
{ NAK @ ····· From MASTER to SLAVE
{ ENQ @ NS 3, 01, 0 ETX CF····· From SLAVE to MASTER

If an no affirmative or negative response is sent from the MASTER unit to the SLAVE unit, the SLAVE unit will send its information message a total of two times to the MASTER unit.

9. MESSAGE STRUCTURE

Address Setting Ranges

The MASTER unit and SLAVE unit machine addresses can be set to numbers from "0" to "26" which, in the message addresses, correspond to the "@" character or to a letter from "A" to "Z", as shown in the following table.

Machine	Machine address	Message address
MASTER unit	0	@
SLAVE unit	1	A
⋮	⋮	⋮
SALVE unit	26	Z

One MASTER unit can be used to control up to four SLAVE units. However, if more than five SLAVE units are used together, the system may not operate.

In information messages sent from the MASTER unit to SLAVE units, designate the SLAVE units using the message addresses.

CONTROL (LISTEN Function)

MASTER end:
ENQ destination address, command ETX BCC1 BCC2
SLAVE end:
ACK self-address or NAK self-address

MONITORING (TALK Function)

MASTER end:
ENQ destination address command ETX BCC1 BCC2
SLAVE end:
ACK self-address or NAK self-address
ENQ destination address message ETX BCC1 BCC2
Controller end:
ACK self-address or NAK self-address

SERVICE REQUESTS

Can be generated at the SLAVE end only when the controller is allowing service requests.
SLAVE end:
ENQ distination address message ETX BCC1 BCC2
MASTER end:
ACK self-address or NAK self-address

10. FUNCTIONS BY COMMAND

Abbreviations: (18-2) = PWR18-2 (36-1) = PWR36-1
(18-T) = PWR18-1T (18-Q) = PWR18-1.8Q
**** = Insert parameter

1. LISTEN Function

1) Output Voltage Set

Command : Setting positive tracking voltage VA **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking voltage VB **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking voltage VC **** (18-T)(18-Q)
Setting negative non-tracking voltage VD **** (18-Q)

Effect : Sets variable reference voltage to message value.

2) Output Current Set

Command : Setting positive tracking current AA **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking current AB **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking current AC **** (18-T)(18-Q)
Setting negative non-tracking current AD **** (18-Q)

Effect : Sets variable reference current to message value.

3) Delay Time Set

Command : Plus set (non-tracking before / tracking after) TA **** (18-T)(18-Q)
Minus set (tracking before / non-tracking after) TB **** (18-T)(18-Q)

Effect : Sets variable delay time to message value.
The DELAY time can be set for PWR18-2 and PWR36-1 as well. The output for these can function as tracking output.

4) Tracking Set

Command : TR0/TR1 (18-2)(36-1)(18-T)(18-Q)

Effect : Selects tracking ON or tracking OFF.
"0" turns tracking off and "1" turns tracking on.
The tracking minus value follows the present tracking puls value. Corresponds with the TRACKING key on the panel.

5) Setting of PRESET Parameters

Command : **Voltage Set**

PRESET 1

Setting positive tracking voltage VE **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking voltage VF **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking voltage VG **** (18-T)(18-Q)
Setting negative non-tracking voltage VH **** (18-Q)

PRESET 2

Setting positive tracking voltage VJ **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking voltage VK **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking voltage VL **** (18-T)(18-Q)
Setting negative non-tracking voltage VM **** (18-Q)

PRESET 3

Setting positive tracking voltage VN **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking voltage VP **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking voltage VQ **** (18-T)(18-Q)
Setting negative non-tracking voltage VR **** (18-Q)

Current Set

PRESET 1

Setting positive tracking current AE **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking current AF **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking current AG **** (18-T)(18-Q)
Setting negative non-tracking current AH **** (18-Q)

PRESET 2

Setting positive tracking current AJ **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking current AK **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking current AL **** (18-T)(18-Q)
Setting negative non-tracking current AM **** (18-Q)

PRESET 3

Setting positive tracking current AN **** (18-2)(36-1)(18-T)(18-Q)
Setting negative tracking current AP **** (18-2)(36-1)(18-T)(18-Q)
Setting positive non-tracking current AQ **** (18-T)(18-Q)
Setting negative non-tracking current AR **** (18-Q)

Delay Set

PRESET 1

Plus set TE **** (18-2)(36-1)(18-T)(18-Q)
Minus Set TF **** (18-2)(36-1)(18-T)(18-Q)

PRESET 2

Plus set TJ **** (18-2)(36-1)(18-T)(18-Q)
Minus Set TK **** (18-2)(36-1)(18-T)(18-Q)

PRESET 3

Plus set TN **** (18-2)(36-1)(18-T)(18-Q)
Minus Set TP **** (18-2)(36-1)(18-T)(18-Q)

Tracking Set I: tracking ON 0: tracking OFF

PRESET 1 TS0/TS1 (18-2)(36-1)(18-T)(18-Q)
PRESET 2 TT0/TT1 (18-2)(36-1)(18-T)(18-Q)
PERSET 3 TU0/TU1 (18-2)(36-1)(18-T)(18-Q)

Effect : Sets PRESET parameters to the message values.

6) Output ON/OFF Set

Command : SW0/SW1 (18-2)(36-1)(18-T)(18-Q)
Effect : The output relayof the power supply is controlled. Setting "0" turns the output OFF, "1" turns the output ON. This function corresponds to that bythe OUTPUT key on the panel.

7) Output protect ON/OFF Set

Command : PT0/PT1 (18-2)(36-1)(18-T)(18-Q)
Effect : Selects the OUTPUT PROTECT function. "0" turns OUTPUT PROTECT off and "1" turns OUTPUT PROTECT on. Corresponds with the OUTPUT PROTECT key on the panel.

8) Display Set

Command : DS1/DS2/DS3/DS4 (18-2)(36-1)(18-T)(18-Q)
Effect : The display contents are selected.

1: +18 V (18-2)(18-T)(18-Q)
+36 V (36-1)
2: −18 V (18-2)(18-T)(18-Q)
−36 V (36-1)
3: +6 V (18-T)
+8 V (18-Q)
4: −6 V (18-Q)

Each corresponds to the respective key on the panel.

9) Display of Delay Time

Command : DT0/DT1 (18-2)(36-1)(18-T)(18-Q)
Effect : Displays the Delay Time

0: Displays V and A
1: Displays the Delay Time

10) PRESET/VARIABLE Selection

Command : PR0/PR1/PR2/PR3 (18-2)(36-1)(18-T)(18-Q)
Effect : Select from "VARIABLE" or PRESET "1" through "3"

0: Variable (18-2)(36-1)(18-T)(18-Q)
1: Preset 1 (18-2)(36-1)(18-T)(18-Q)
2: Preset 2 (18-2)(36-1)(18-T)(18-Q)
3: Preset 3 (18-2)(36-1)(18-T)(18-Q)

Each corresponds to the respective key on the panel.

11) LOCAL Mode Set

Command : LC1 (18-2)(36-1)(18-T)(18-Q)
Effect : Shifts operation to LOCAL mode.

12) LOCAL Lockout Set

Command : LL1 (18-2)(36-1)(18-T)(18-Q)

Effect : Prohibits shifting to the LOCAL mode, so that even if the LOCAL key on the panel is pressed, the machine will not go into the LOCAL mode.

13) Status Output Request

Command : STO/ST1/ST2/ST3 (18-2)(36-1)(18-T)(18-Q)

Effect : Requests output of the power supply's internal status information. The unit that receives this command adds on the preceding applicable message and transmits an information message.

- 0: Output request for information on output current, output voltage, operation mode
- 1: Output request for information on VARIABLE/all PRESETs
- 2: Output request for information on status of all keys.
- 3: Output request for ID information

Applicable preceding messages

- ST0: MS0
- ST1: MS1
- ST2: MS2
- ST3: MS3

Conditions: Cannot be used in the broadcast mode.

2. TALK Function

1) Output of Output Voltage, Output Current, Operation Status

Corresponding command : ST0 (18-2)(36-1)(18-T)(18-Q)

Preceding message : MS0

Effect : Transmits information on Output Voltage, Output Current, and Operation Status.

Format : MS0, **, ****, ****, *******, **** (18-2)(36-1)

- Columns 1, 2 Machine address
- Columns 4~7 +18/+36 voltage
- Columns 9~12 +18/+36 current
- Columns 14~17 −18/−36 voltage
- Columns 19~22 −18/−36 current
- Columns 24~27 Operation status

Format : MS0, **, ****, ****, *******, **** (18-T)

- Columns 1, 2 Machine address
- Columns 4~7 +18 voltage
- Columns 9~12 +18 current
- Columns 14~17 −18 voltage
- Columns 19~22 −18 current
- Columns 24~27 +6 voltage
- Columns 29~32 +6 current
- Columns 34~37 Operation status

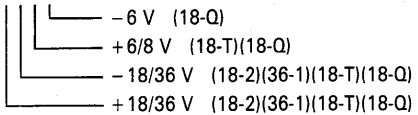
Format : MS0, **, ****, ****, *******, **** (18-Q)

- Columns 1, 2 Machine address
- Columns 4~7 +18 voltage
- Columns 9~12 +18 current
- Columns 14~17 −18 voltage
- Columns 19~22 −18 current
- Columns 24~27 +8 voltage

Columns	29~32		+8 current
Columns	34~37		−6 voltage
Columns	39~42		−6 current
Columns	44~47		Operation status

The comma (,) is used as the data separator

Operation Status ＊＊＊＊ 0: CV, 1: CC unused portion is 0.



2) Output of Information on VARIABLE/all PRESETs

Command : ST1 (18-2)(36-1)(18-T)(18-Q)

Preceding message : MS1

Effect : Ouotputs information stored in all PRESETs

Format : MS1, ＊＊, ＊＊＊＊, ＊＊＊＊, ＊＊＊＊＊＊＊, ＊＊＊＊ (18-2)(36-1)

Columns	1, 2		Machine address
Columns	4~7	VARIABLE	+18/+36 voltage
Columns	9~12		+18/+36 current
Columns	14~17		−18/−36 voltage
Columns	19~22		−18/−36 current
Culumn	24		Delay plus/minus
Columns	26~29		Delay time
Column	31		Tracking
Columns	33~36	PRESET 1	+18/+36 voltage
Columns	38~41		+18/+36 current
Columns	43~46		−18/−36 voltage
Columns	48~51		−18/−36 current
Culumn	53		Delay plus/minus
Columns	55~58		Delay time
Column	60		Tracking
Columns	62~65	PRESET 2	+18/+36 voltage
Columns	67~70		+18/+36 current
Columns	72~75		−18/−36 voltage
Columns	77~80		−18/−36 current
Column	82		Delay plus/minus
Columns	84~87		Delay time
Column	89		Tracking
Columns	91~94	PRESET 3	+18/+36 voltage
Columns	96~99		+18/+36 current
Columns	101~104		−18/−36 voltage
Columns	106~109		−18/−36 current
Culumn	111		Delay plus/minus
Columns	113~116		Delay time
Column	118		Tracking

Tracking 0: ON, 1: OFF

Comma (,) used as the data separator.

Format : MS1, ＊＊, ＊＊＊＊, ＊＊＊＊, ＊＊＊＊＊＊＊, ＊＊＊＊ (18-2)(36-1)

Culumns	1, 2		Machine address
Columns	4~7	VARIABLE	+18 voltage
Columns	9~12		+18 current
Columns	14~17		−18 voltage
Columns	19~22		−18 current
Columns	24~27		+6 voltage
Columns	29~32		+6 current
Culumn	34		Delay plus/minus
Columns	36~39		Delay time
Culumn	41		Tracking

Columns	43~ 46	PRESET 1	+18 voltage
Columns	48~ 51		+18 current
Columns	53~ 56		−18 voltage
Columns	58~ 61		−18 current
Columns	63~ 66		+6 voltage
Columns	68~ 71		+6 current
Column	73		Delay plus/minus
Columns	75~ 78		Delay time
Column	80		Tracking
Columns	82~ 85	PRESET 2	+18 voltage
Columns	87~ 90		+18 current
Columns	92~ 95		−18 voltage
Columns	97~100		−18 current
Columns	102~105		+6 voltage
Columns	107~110		+6 current
Column	112		Delay plus/minus
Columns	114~117		Delay time
Column	119		Tracking
Columns	121~124	PRESET 3	+18 voltage
Columns	126~129		+18 current
Columns	131~134		−18 voltage
Columns	136~139		−18 current
Columns	141~144		+6 voltage
Columns	146~149		+6 current
Column	151		Delay plus/minus
Columns	153~156		Delay time
Column	158		Tracking

Delay Plus/Minus: 0: Plus, 1: Minus

Tracking: 0: Off, 1: On

Comma (,) used as the data separator.

Format

: MS1, **, ****, ****, *******, **** (18~Q)

Columns	1, 2		Machine address
Columns	4~ 7	VARIABLE	+18 voltage
Columns	9~ 12		+18 current
Columns	14~ 17		−18 voltage
Columns	19~ 22		−18 current
Columns	24~ 27		+8 voltage
Columns	29~ 32		+8 current
Columns	34~ 37		−6 voltage
Columns	39~ 42		−6 current
Column	44		Delay plus/minus
Columns	46~ 49		Delay time
Column	51		Tracking
Columns	53~ 56	PRESET 1	+18 voltage
Columns	58~ 61		+18 current
Columns	63~ 66		−18 voltage
Columns	68~ 71		−18 current
Columns	73~ 76		+8 voltage
Columns	78~ 81		+8 current
Columns	83~ 86		−6 voltage
Columns	88~ 91		−6 current
Column	93		Delay plus/minus
Columns	95~ 98		Delay time
Column	100		Tracking
Columns	102~105	PRESET 2	+18 voltage
Columns	107~110		+18 current
Columns	112~115		−18 voltage
Columns	117~120		−18 current
Columns	122~125		+8 voltage

Columns 127~130			+8 current
Columns 132~135			−6 voltage
Columns 137~140			−6 current
Column	142		Delay plus/minus
Columns 144~147			Delay time
Column	149		Tracking
Columns 151~154		PRESET 3	+18 voltage
Columns 156~159			+18 current
Columns 161~164			−18 voltage
Columns 166~169			−18 current
Columns 171~174			+8 voltage
Columns 176~179			+8 current
Columns 181~184			−6 voltage
Columns 186~189			−6 current
Column	191		Delay plus/minus
Columns 193~196			Delay time
Column	198		Tracking

Delay Plus/Minus: 0: Plus, 1: Minus

Tracking: 0: Off, 1: On

Comma (,) used as the data separator.

3)Status Output for All Keys

Command : ST2 (18-2)(36-1)(18-T)(18-Q)

Preceding Message : MS2

Effect : Outputs status of all keys.

Format : MS2, **, *, *, *, *, *, *, (18-2)(36-1)(18-T)(18-Q)

Columns	1, 2	Machine address
Column	4	Display
		0:
		1: +18 V (18-2)(18-T)(18-Q)
		+36 V (36-1)
		2: −18 V (18-2)(18-T)(18-Q)
		−36 V (36-1)
		3: +6 V (18-T)
		+8 V (18-Q)
		4: −6 V (18-Q)
Column	6	Output Switch
		0: all OFF
		1: Tracking ON, Non-tracking OFF
		2: Tracking OFF, Non-tracking ON
		3: all ON
Column	8	Output Protect
		0: OFF, 1: ON
Column	10	Tracking
		0: OFF, 1: ON
Column	12	PRESET/VARIABLE
		0: VARIABLE
		1: PRESET 1
		2: PRESET 2
		3: PRESET 3

4) ID Information Output

Command : ST3 (18-2)(36-1)(18-T)(18-Q)
Preceding message : MS3
Effect : Outputs ID information.
Format : MS3, **, * (18-2)(36-1)(18-T)(18-Q)
Columns 1, 2 Machine address
Column 4 ID Information
0: PWR 18-1. 8Q
1: PWR 18-1T
2: PWR 18-2
3: PWR 36-1

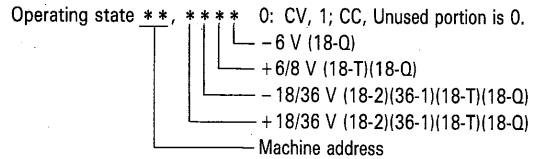
3. SERVICE REQUEST Function

1) Service Request Allow/Disallow

Command : SR0/SR1 (18-2)(36-1)(18-T)(18-Q)
Effect : Sets the Service Request function to "allow" or "disallow".
"0" disallows Service Requests and "1" allows Service Requests.

2) Constant Voltage/Constant Current Mode Change Notification

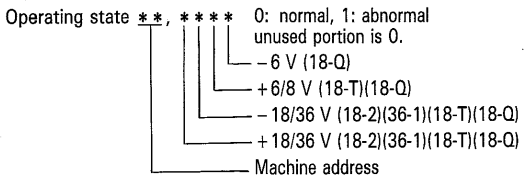
Message : CC1, **, **** (18-2)(36-1)(18-T)(18-Q)



The notification signal is generated in the Service Requests "allowed" state, when the machine shifts from the constant voltage to constant current mode, or from the constant current to constant voltage mode.

3) Notification of Alarm Mode on Output Voltage with Error

Message : UU1, **, **** (18-2)(36-1)(18-T)(18-Q)



This notification is made, under a service request authorized condition, when an error-containing output voltage becomes output or when an error-containing voltage output condition is returned to an error-free voltage output condition.

11. PARAMETER SET RANGES

Voltage

0000 ~ 0617	(6.17 V)	(18-T)(18-Q)
0000 ~ 0823	(8.23 V)	(18-Q)
0000 ~ 1850	(18.50 V)	(18-2)(18-T)(18-Q)
0000 ~ 3650	(36.50 V)	(36-1)

Current

0002 ~ 0104	(1.04 A)	(36-1)(18-T)
0003 ~ 0185	(1.85 A)	(18-Q)
0004 ~ 0206	(2.06 A)	(18-2)
0010 ~ 0512	(5.12 A)	(18-T)

Delay Time

0000 ~ 1000	(0.00 ~ ± 10 sec)	(18-T)(18-Q)

Parameters can be set in digits other than 4-digits.
Example: Setting 5 V
Either "0500" or "500" can be specified as 5 V. Take note that specifying "5" results in the voltage being set at 0.05 V.

12. REMOTE CONTROL SAMPLE PROGRAMS

This sample program is for remote controlling all PWR functions utilizing RS-232C.
It also functions as a program for making efficient RS-232C transmission.
After building this program, set variables for each function by referring to the operation manual.

```
1000 *INIT
1010     OPEN "COM:E71NN" AS #1
1020     KEY 1,"  TX"
1030     ON COM GOSUB *RX
1040     ON KEY GOSUB *TX
1050     COM ON
1060     KEY(1) ON
1070 *MAIN
1080     GOTO *MAIN
1090 *TX
1100     PRINT
1110     INPUT "Address";A$
1120     LINE INPUT "Command? ";C$
1130     B=ASC(A$)+&H3
1140     FOR I=1 TO LEN(C$)
1150         B=B+ASC(MID$(C$,I,1))
1160     NEXT
1170     B1$=LEFT$(RIGHT$(HEX$(B),2),1)
1180     B2$=RIGHT$(RIGHT$(HEX$(B),2),1)
1190     TL$=CHR$(5)+A$+C$+CHR$(3)+B1$+B2$
```

Communication Circuit Initialization Routine (The F.1 key initiates transmission)

Main loop

Command input

Block check character computation routine

Block check character conversion routine

```
1200 *TX01
1210     IF CT>5 THEN CT=0:GOTO *MAIN
1220     FOR I=1 TO LEN(TL$)
1230         T$=MID$(TL$,I,1)
1240         EF=0
1250         GOSUB *TX02
1260         IF EF=1 THEN CT=CT+1:GOTO *TX01
1270     NEXT
1280     RETURN
1290 *TX02
1300     COM STOP
1310     FOR L=1 TO 10
1320         IF LOC(1)<>0 THEN RETURN
1330     NEXT
1340     PRINT #1,T$;
1350     IF INPUT$(1,#1)<>T$ THEN EF=1
1360     COM ON
1370     RETURN
1380 *RX
1390     IF LOC(1)=0 THEN RETURN
1400     R$=INPUT$(1,#1)
1410     IF R$<>CHR$(5) THEN *RX00
1420     R$=INPUT$(1,#1)
1430     RB=ASC(R$)
1440     RL$=""
1450 *RX01
```

Abandon after fifth retransmission

Transmission routine call

Error flag check

Reception interrupt disallow

Carrier sensing (simulated)

One-character transmission

Echo-back check

Reception interrupt allow

Leading control character hold

Address reception

```
1460    R$=INPUT$(1,#1)
1470    IF R$=CHR$(3) THEN *RX02
1480    RB=RB+ASC(R$)
1490    RL$=RL$+R$
1500    GOTO *RX01
1510 *RX02
1520    RB=RB+&H3
1530    RB1$=INPUT$(1,#1)
1540    RRB1$=LEFT$(RIGHT$(HEX$(RB),2),1)
1550    RB2$=INPUT$(1,#1)
1560    RRB2$=RIGHT$(RIGHT$(HEX$(RB),2),1)
1570    IF RB1$=RRB1$ AND RB2$=RRB2$ THEN *RX03
1580    COM STOP
1590    PRINT #1,CHR$(15);"@";
1600    COM ON
1610    GOTO *RX00
1620 *RX03
1630    COM STOP
1640    PRINT #1,CHR$(6);"@";
1650    COM ON
1660    FOR I=1 TO LEN(RL$)
1670        P$=MID$(RL$,I,1)
1680        PRINT P$;
1690    NEXT
1700 *RX00
1710    IF LOC(1)<>0 THEN R$=INPUT$(LOC(1),#1)
1720    RETURN
```

Message reception

BCC calculation

BCC calculation and comparison

Negative response transmission

Affirmative response transmission

Reception message display

A product of
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