SPECIFICATION

HONEYWELL 635 COUPLER

HONEYWELL SERIES 700

SYSTEMS

NOTE:

HONEYWELL 635 COMPUTER WAS
PREVIOUSLY KNOWN AS THE
GENERAL ELECTRIC 635 COMPUTER

REV.

1. ISSUE NOVEMBER 29, 1972

2. REISSUE DECEMBER 5, 1972

3. REISSUE DECEMBER 7, 1972

	CONTENTS	PAGE

	FIGURE	PAGE

700/635 Coupler

1. Scope

   The purpose of this document is to define a hardware
interface between a Honeywell Series 700 computer and a
Honeywell 635 IOC unit. The reference for this discussion
will be pertinent documentations available from Honeywell
Information Systems (HIS).

   1. Type 716 Central Processor unit maintenance manual
      DOC. NO. 70130072627.

   2. System 700 programmers reference manual DOC. NC.
      701300 72575.

   3. Honeywell/General Electric product specification
      for the common peripheral interface DOC. NO. 43A130524.

GENEPAL

   The Honeywell Series 700 to 635 IOC interface will consist
of one 635 Interface Control Module (ICM) and one 700 DMA Data
Control Module (DCM). The 635 coupler will provide control of
the selection, deselection, termination, and data transfer
capabilities between the two computer types. In addition the
coupler will provide a special link between the two CPU's for
down line program loading and start up. This down line load
and start up will be under total control of the H-635 IOC.

CONFIGURATION

   The H-635/H-700 coupler consisting of the ICM and will plug
into the H-700 I/O bus. Each module will be a wire-wrapped
"A" size boards requiring two slots in the I/O bus. The coupler
will interface to one channel of DMA, the standard interrupt,
and program I/O logic.

One cable having edge connector to u-pac connector plus one cable having u-pac connector to open end. All pulse converting receiver/driver logic will be contained in one 1 x 3 bloc. The 700 system will supply all power required for the coupler.

PARITY

The 635/700 coupler will test and generate parity on all inbound and outbound information. If the 635 device code or OP - code have incorrect parity, the coupler will reject the command. When a command parity error is received, major status will be encoded for command reject and no interrupt will be made to the H-700 system. When a data parity error is received, the operation will be terminated with device data alert status, and interrupt the H-700 system.

SOFTWARE PROGRAMMING

The 635/700 coupler will be programmed using Honeywell's system 700 Programmers' Reference Manual, Documentation Number 70130072575 and the appropriate 635 IOC manuals.

INSTRUCTION REPERTOIRE
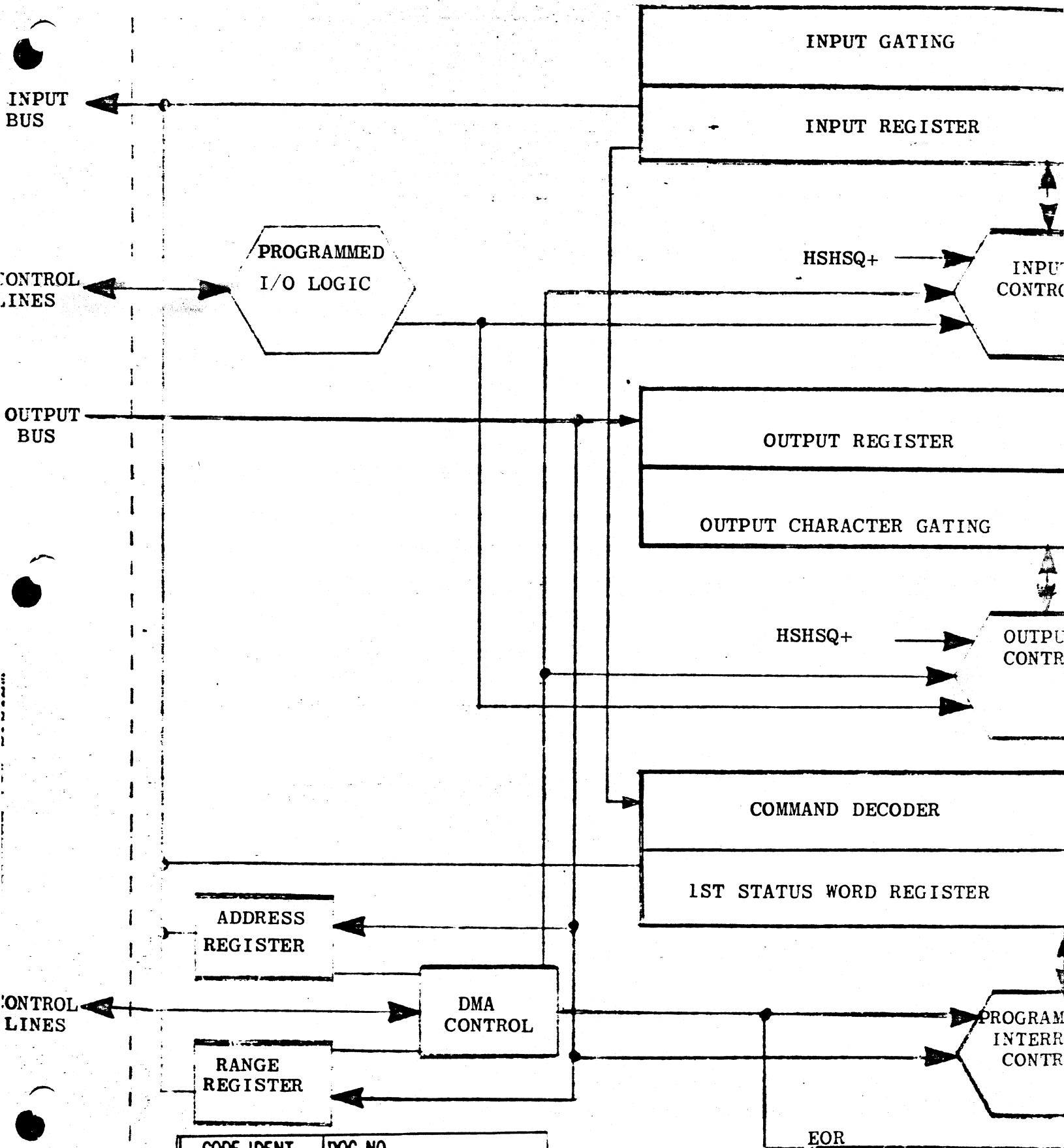
The 635/700 coupler will have a device address of 35 and have the following instruction repertoire.

Instruction	Code	
INA	'1035	Transfer contents of the coupler's input register to the 700 system's "A" register.
OTA	'1035	Transfer contents of the 700 system's "A" register to the coupler's output register.
OCP	'1135	Enable coupler loop-test mode.

Instruction	Code	
OCP	'1235	Acknowledge and reset interrupt.
INA	'1235	Input first status word of the 700 system "A" register.
SKS	'1235	Skip, if not at end of operation.
OCP	'1335	Set the special 635 IOC interrupt in the coupler. This OCP is sent to the IOC to notify it that the 700 system wants to receive a 635 read command.
OCP	'1435	Enable DMA channel for transfers to or from the 700 system. This instruction is issued after the starting address and range registers have been loaded.
INA	'1435	Input the contents of the DMA starting address register to the 700 system "A" register.
OTA	'1435	Output the contents of the 700 system "A" register to the DMA starting address register.
OCP	'1535	Enable the coupler's interrupt make.
INA	'1535	Input the contents of the DMA range register to the 700 system's "A" register.
OTA	'1535	Output the contents of the 700 system's "A" register to the DMA range register.
OCP	'1635	Reset the coupler's interrupt mask.
OCP	'1735	Initialize the coupler.

Instruction	Code	
OCP	'1235	Acknowledge and reset interrupt.
INA	'1235	Input first status word of the 700 system "A" register.
SKS	'1235	Skip, if not at end of operation.
OCP	'1335	Set the special 635 IOC interrupt in the coupler. This OCP is sent to the IOC to notify it that the 700 system wants to receive a 635 read command.
OCP	'1435	Enable DMA channel for transfers to or from the 700 system. This instruction is issued after the starting address and range registers have been loaded.
INA	'1435	Input the contents of the DMA starting address register to the 700 system "A" register.
OTA	'1435	Output the contents of the 700 system "A" register to the DMA starting address register.
OCP	'1535	Enable the coupler's interrupt make.
INA	'1535	Input the contents of the DMA range register to the 700 system's "A" register.
OTA	'1535	Output the contents of the 700 system's "A" register to the DMA range register.
OCP	'1635	Reset the coupler's interrupt mask.
OCP	'1735	Initialize the coupler.

INPUT
BUS

INPUT GATING

INPUT REGISTER

PROGRAMMED
I/O LOGIC

HSHSQ+ → INPUT
CONTRO

CONTROL
LINES

OUTPUT
BUS

OUTPUT REGISTER

OUTPUT CHARACTER GATING

HSHSQ+ → OUTPU
CONTR

COMMAND DECODER

1ST STATUS WORD REGISTER

ADDRESS
REGISTER

DMA
CONTROL

CONTROL
LINES

PROGRAM
INTERR
CONTR

RANGE
REGISTER

EOR

CODE IDENT	DOC NO	
07573	'00°C5°3	
SCALE NONE	REV 2	SHEET 4 OF

Honeywell
HONEYWELL INFORMATION SYSTEMS INC.
FRAMINGHAM COMPUTER OPERATIONS

PARITY COMPARATOR

PARITY GENERATOR

STATUS ENCODER

MAJOR STATUS REGISTER

STATUS RESET CONTROL — CLEAR

HSHSQ+

HANDSHAKE SEQUENCER

LOOP BACK TEST LOGIC

LOGIC LEVEL TO PULSE CONVERTERS

635 IOC

ILTPO+
ILTPO+
PRTTP+
WRCLK+
WCRQT
ILFPO+
ILFP5+
PRTFP+
RDACK+
RDCLK
MSFPO+
MSFP3+
SINFP+
EDTRF+
TERLI+
PRFRS+
IOLTP+
EXTRS
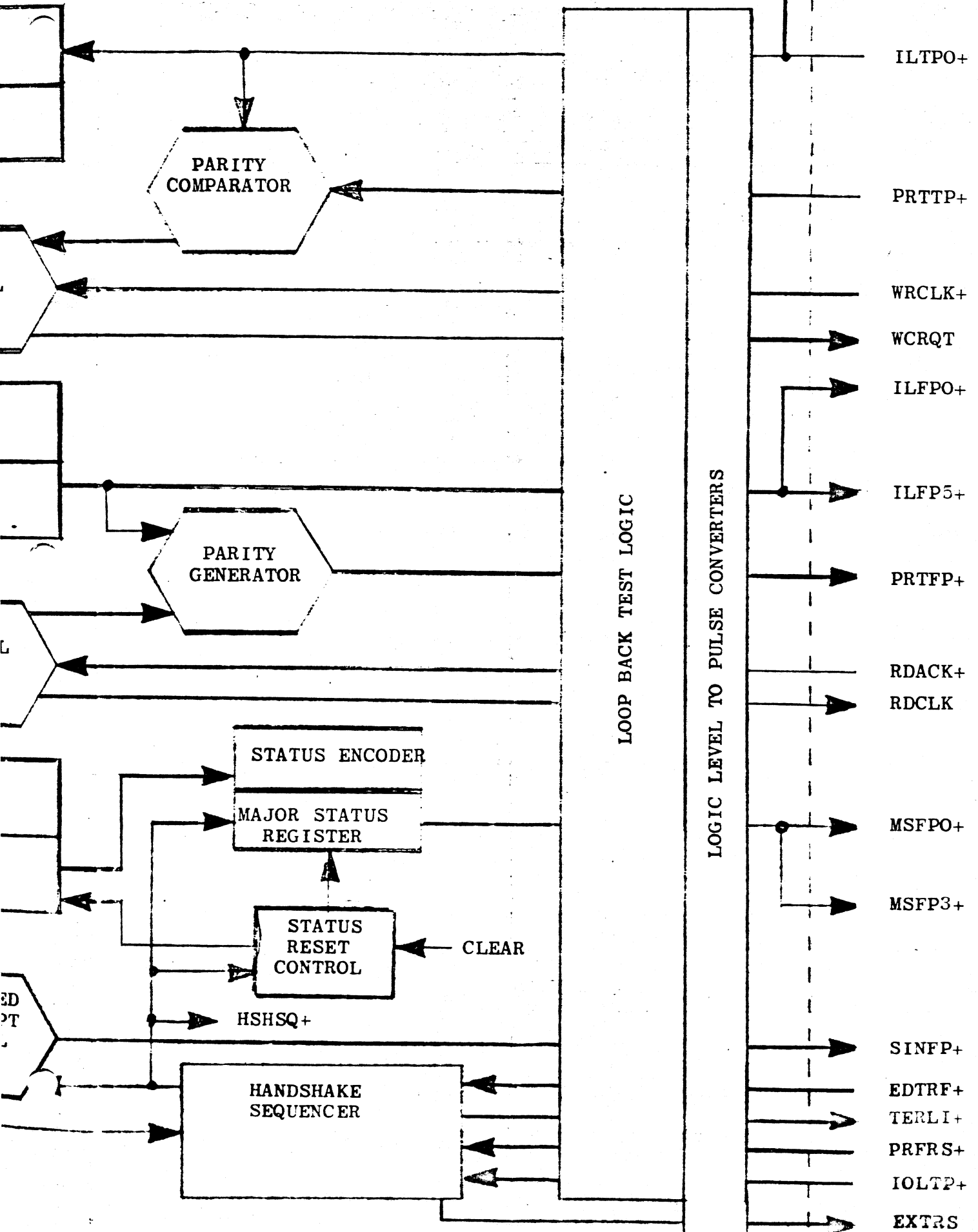
Coupler-First Status Word

The first status word represents status conditions of the coupler which the 700 program should be made aware of. This 16 bit status word is input to the "A" register via an INA '1235 instruction. The bits are placed in 3-bit groups as follows:

Groups	Status Information
1	Coupler operational (single bit)
2	Coupler state
3	Startup status
4	Termination status
5	Character counters
6	Interrupt cause

Bit Code Description

1   OP   Coupler Operational

This bit will be on if all the following are true:

    1.   The coupler is not busy.

    2.   The coupler is active.

    3.   The last operation completed with ready major status.

2   B   Coupler busy

This bit is on while the coupler is transferring data via the DMA.

3   A   Coupler active

This bit is on when the peripheral reset line from the IOC is enabled.

4   SI   Loop-test mode

The coupler is enabled for loop back tests.

5   R   635 Read command received

This bit is turned on by the coupler to request an address and range for a read or dump operation. It is turned off by an OCP '1435.

Bit Code Description

6	W	635 Write command received

This bit is turned on by the coupler to request
an address and range for a write or load operation.
It is turned off by an OCP '1435.

7	DL	635 Dump/load mode

This bit is turned on with bit 5 or 6 to indicate
a dump or load command has been received.

8	CT	Improper buffer size

This bit is on to indicate that the receiving buffer
was smaller than the transmitting buffer. The
receiving end (716 or IOC) had to stop the exchange
because its buffer was full while the sender (IOC or 716)
had more data to send. The IOC is informed of this
condition by a termination status of data alert and
substatus of improper buffer size.

9	DE	635 Data parity error

The previous write was ended by a character with
bad parity.

10	TE	635 Transfer timing error

The last operation was terminated by the 5 sec. timer.
Bits 8, 9, and 10 are the same as the data alert
substatus bits.

11 & 12	RC	Read character counter

This counter is used by the coupler to gate characters
from the output register to the IOC. The final value
of this counter may be used by the software check
that the last word was completely filled.

13 & 14	WC	Write character counter

Like bits 9 & 10 except used for write operations.

Bit Code Description

15	DI	Coupler going active interrupt request
		Bit 3 just turned on. The coupler may now be used.
16	BI	Coupler going not busy interrupt request
		Bit 2 just turned off. An operation just finished.
		Other bits should be checked for errors.

DATA PACKING

The 635/700 coupler will transfer information between the two computers and the information will all be transparent to the coupler except for commands from the 635 to the 700 system. The 635 software stores ASCII characters in 9 bit fields. The 36 bit 635 word containing four 9 bit characters will be transferred as six 6 bit characters by the IOC. The high order bit of each of the four 9 bit characters would be lost or set to zero by the process.

The coupler would group three of the six bit characters together, less the two bits which are lost, into one 16 bit 700 system word. The data packing format will be as shown in figure 2.
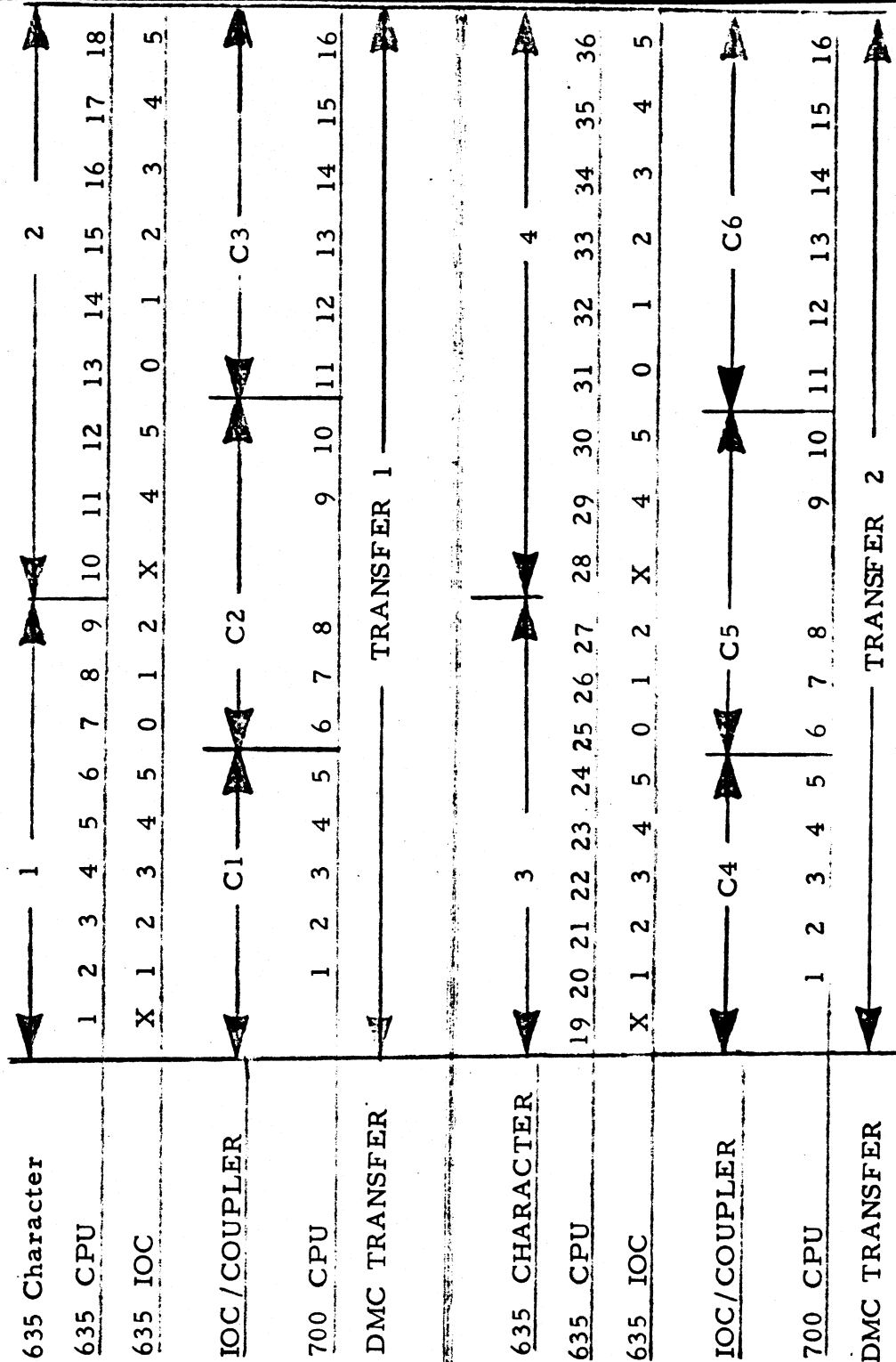
FUNCTIONAL DESCRIPTION

Receiving Read and Write Commands

The coupler will be programmed as a standard DMA channel for all data transfers. When a 635 Read or Write command requiring data transfer is received, the series 700 program will receive an interrupt. The program will than input the first status word via INA '1235 and there by determine what command was received. The program may, if desired, at this point input the device address and command code from the input register, via INA '1035. The third step will be to set up the DMA channel of the coupler with the appropriate starting address and range for the command received. The DMA will then be enabled via OCP '1436.

DATA PACKING

WORD FORMAT

FIGURE 2

635 Character

635 CPU

635 IOC

IOC/COUPLER

700 CPU

DMC TRANSFER

635 CHARACTER

635 CPU

635 IOC

IOC/COUPLER

700 CPU

DMC TRANSFER

TRANSFER 1

TRANSFER 2

SIZE	CODE IDENT	DOC NO
A	07573	70090500
SCALE NONE	REV 2	SHEET 9 OF

The coupler will set the major status to the busy state automatically when receiving a Read or Write command.

When a 635 write command is received, the coupler will input into its 16 bit register the first three 6 bit characters, while the above program set ups are being done. Once the three characters have been received and OCP '1436 has been sent, the coupler will generate the first DMA transfer request. The issuing of OCP '1435 will also release the 700 program from any further coupler requirements until it receives an interrupt indicating block transfer complete (BTC).

This BTC will be the result of the DMA end-of-range and the successful transfer of all data between the IOC and the coupler. During a write command the end-of-range will be forced by the coupler when an end-DATA-transfer is received from the 635 IOC.

Major And Substatus

The status conditions reflected to the IOC are as follows:

Major $2^3\,2^2\,2^1\,2^0$	Substatus $2^5\,2^4\,2^3\,2^2\,2^1\,2^0$	
0 0 0 0	0 0 0 0 0 0	Ready The previous operation completed without error.
0 0 1 1	0 0 0 0 0 1	Data Alert, Transfer Timing Error The peripheral subsystem is busy and no data has been transferred within 5 seconds.
0 0 1 1	0 0 0 0 1 0	Data Alert, Parity Error A data character with bad parity was received.

Major	Substatus	
0 0 1 1	0 0 0 1 0 0	Data Alert, Improper Buffer Size The receiving buffer was smaller than the transmitting buffer. Some of the data was not transferred.
0 1 0 1	0 0 0 0 0 0	Command Reject An illegal command was received on the device number or command had imporper parity. The legal commands are: request status (00), reset status (40), read, write, dump, and load.
1 0 0 0	0 0 0 0 0 0	Subsystem Busy This status is returned by the coupler after properly receiving a command involving data transfers.

Down Line Dump/Load

The 635/700 coupler will receive and decode both dump and load commands. These two commands will assume the following condition:

1. That the 700 software has failed and is unusable.
2. That the 700 system CPU may have stopped and has to be restarted.

The dump or load command will be received into the input register and decoded by the command decoder. When one of these commands are detected, the coupler interrupt and the 16 input bus lines will be inhibited. This will insure that the 700 software is not used.

The coupler will automatically clear both DMA registers and preset the address register to '55 and the range register for a single transfer. At this time the DMA will be enabled for transfer, followed by activation of the BSTART signal on the

700 I/O bus. BSTART is the watchdog timer interface signal to
the 700 CPU, which is also going to be used by the coupler. The
activation of BSTART will start the CPU running if it is not
running and cause an interrupt, resulting in a JST instruction to
be done through location '55. The DMA will do one transfer
into location 55 of all zeros prior to the JST. The reason for
sequence is that the DMA break has priority over the watchdog
timer interrupt break. The JST instruction will store the contents
of the "P" counter in location zero and do the instruction in
locations '1 through '17. These 17 octal locations can be used
because they are protected, and will contain a program with a
basic format as follows:

OCTAL LOCATION	INSTRUCTION		DESCRIPTION
0			Contains contents of "P" counter prior to interrupt.
1	INA	'1235	Input first coupler status word.
2	HLT		Error halt. (INA '1235 should always ship)
3	STA		Store first status word
4	LDA	C1	Load DMA starting address
5	OTA	'1435	Output DMA starting address
6	HLT		Error halt
7	LDA	C2	Load DMA range
10	OTA	'1535	Output DMA range
11	HLT		Error halt
12	OCP	'1435	Enable DMA for transfer and reset ECR interrupt inhibit except for a dump command.
13	SKS		Skip, if not at end of operation.
14	JMP		Go to new program
15	JMP	*-2	Wait
16	C1		DMA starting address constant
17	C2		DMA range constant

Dump Command

When a dump command has been issued by the IOC and the above
sequence has been performed then the DMA will transfer the block
of data to the IOC and remain in the wait mode at end of range
time. All interrupts will be inhibited during a dump command.
It will be up to the IOC to issue another command such as a load
command.

Load Command

The IOC may issue a load instruction anytime, provided that
it has determined that the 700 system has power on. The above
startup procedure will occur when the load command is received
and the SKS 7235 will not skip and transfer control from the down
line loader program to the program just loaded. All interrupts
will be inhibited during a load command.

Coupler Time Outs

700 System failure -- The 635/700 coupler will have an internal
watchdog timer set for 5 seconds. This time-out will indicate
that a command is presently being executed and there hasn't been
a data strobe for 5 seconds. The time-out will automatically send
a terminate to the 635, and also set device data alert major status
and special substatus. This time-out will indicate to the 635
that a 700 program dump and load may be necessary. There will be
a way to disable the time-out while testing.

Data Rate Control -- The 635/700 coupler will have a time-out
which will set a maximum transfer rate for the coupler. This
control will make the coupler compatible with some of the slower
IOC channel.

Status Responses to Commands From IOC

Command	Responses
Request Status	Ready - The previous operation terminated successfully or status has been reset by any command other than Request Status.
	Data Alert - The previous operation terminated with an error. The appropriate substatus is also returned.
Reset Status	Ready - If the previous operation terminated with Data Alert then that condition is reset.
Read, Write, Dump, or Load	Busy - This is the only status which will be returned at command initiation.
	Data Alert - This status will be returned at termination if an error occurs during the transmission.
	Ready - This status will be returned at termination if the command was successful.

Special 635 IOC Interrupt

The 635/700 coupler will provide means for 700 system to interrupt the 635 IOC because of an alert status condition or that it would like to receive a read command. The 700 program can request a read command by issuing OCP '1335 which will activate the special interrupt line to the IOC.

When the IOC receives a special interrupt it should return with read command. If the status has a device data alert code, the IOC should take the appropriate action.

Loop-back Test Mode

The 635/700 coupler will have a loop back test mode which will be activated via OCP '1135 and reset by OCP '1735. When in this test mode the output data and control lines will be looped back to the input data and control lines via special gating. In addition, there is some special sequence control logic required.