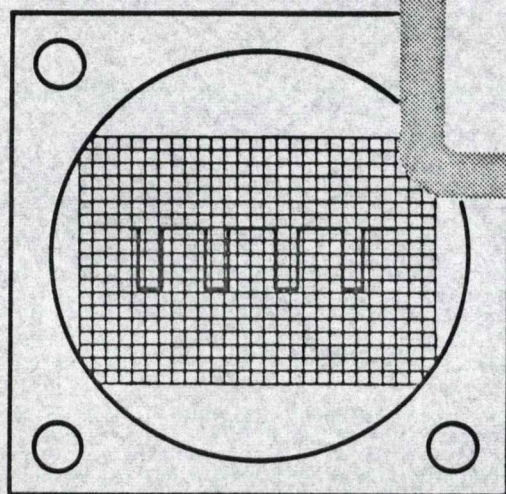


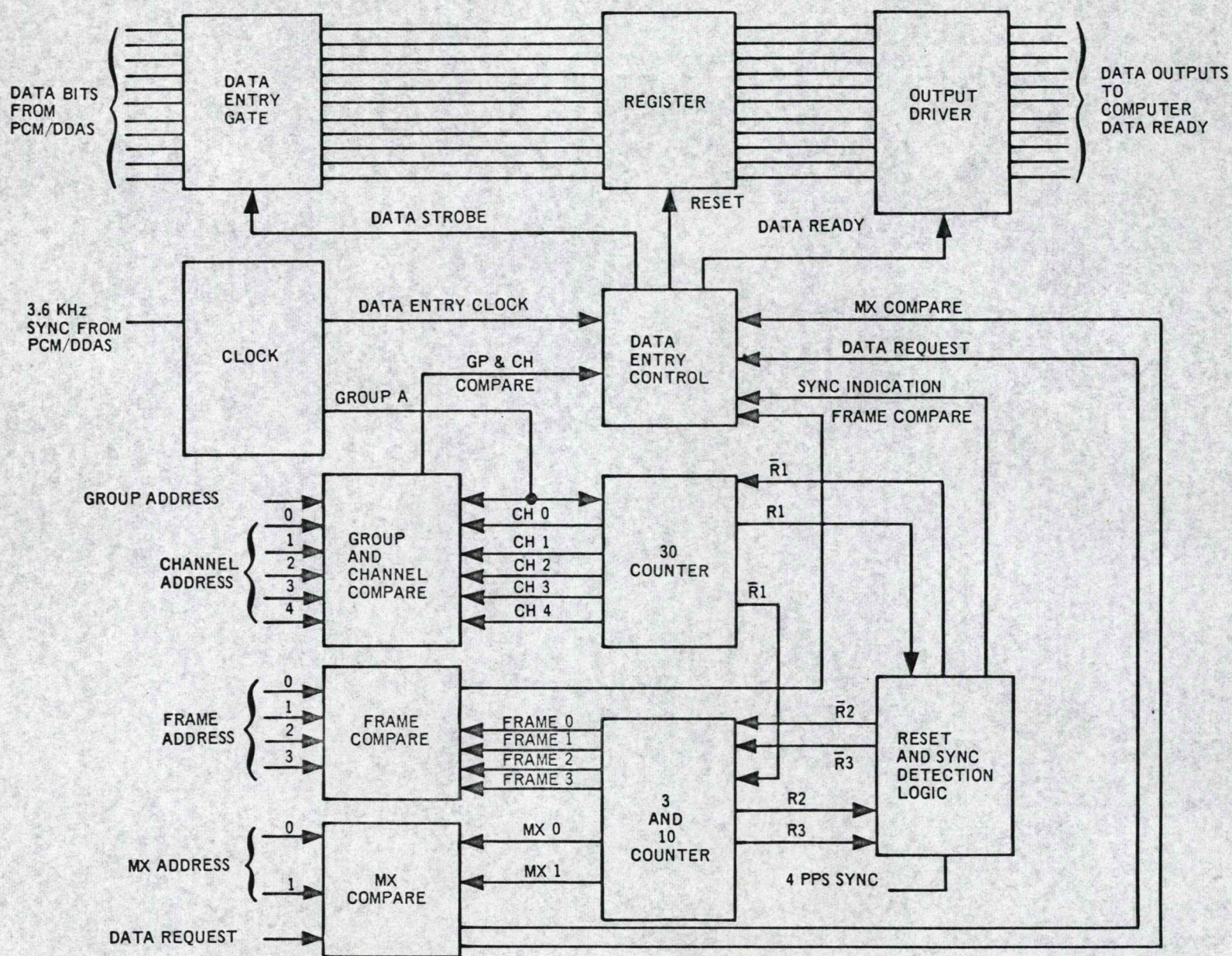
**MAINTENANCE  
AND  
INSTRUCTION MANUAL  
DIGITAL DATA ACQUISITION  
SUBSYSTEM/COMPUTER  
INTERFACE UNIT  
MODEL 501  
(50M66520)**



**GEORGE C. MARSHALL SPACE FLIGHT CENTER  
ASTRONICS LABORATORY - INSTRUMENTATION AND COMMUNICATIONS  
DIVISION TELEMETRY SYSTEMS BRANCH**



Figure 1-1. DDAS/CIU Assembly, Model 501, General Block Diagram





## SECTION II

### THEORY OF OPERATION

#### 2.1 GENERAL

The CIU is designed to perform the appropriate interface functions between two non-synchronous digital subsystems, the guidance computer, and the PCM system. The PCM system is a digital data handling system having a number of sampled data channels occurring in a repetitive time-division format, while the guidance computer is a digital data processing system. The CIU provides selective transfer of data from the PCM system to the computer. The computer identifies the specific data channel to be transferred by means of a 12-bit channel address. Upon receipt of a valid data request signal from the computer, the CIU initiates a transfer sequence consisting of the following functions:

- a. Await the next appearance of the data word specified by the channel address.
- b. Write the data word into a ten-bit holding register within the CIU.
- c. Provide a data-ready signal to the computer indicating that the selected data is available.

As long as the data request signal remains at the request level, subsequent samples of the selected channel will be transferred into the holding register as they appear in the PCM format. When the data request signal is returned to the standby level, the last data word transferred will remain in the holding register until another transfer sequence is initiated.

#### 2.2 DETAILED OPERATION

This section contains a detailed description of the operation of the Computer Interface Unit. The theory of operation is given for each logic card down to, but not including, the welded modules. Each card description includes the theory, a logic diagram of the card, and timing waveforms where applicable. The appropriate electrical schematics are contained in Appendix D.



## APPENDIX G

### LOGIC DIAGRAMS

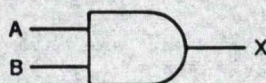
#### LOGIC SYMBOLS

Logic diagrams are used in this manual to aid in explaining the theory of operation of the PC boards. The control pulses, generated by the PC boards, are expressed in the text in the form of Boolean algebra equations. A brief explanation of the logic symbols and Boolean algebra symbols follows:

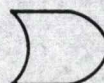
The AND symbol is



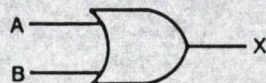
and with two inputs is



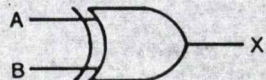
The OR symbol is



and with two inputs is



EXCLUSIVE OR



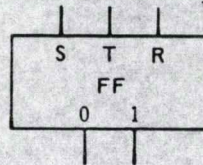
The STATE INDICATOR (active) is a small circle at the input or output terminal of a logic element.





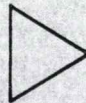
The small circle at the input indicates that the relatively low (L) signal activates the function. The small circle at the output indicates that the activated function output is relatively low. The absence of the small circle indicates that the relatively high (H) signal is the active signal.

The FLIP-FLOP symbol is



where set (s), reset (R), trigger (T), flip-flop (FF) and 0, 1 are the binary states.

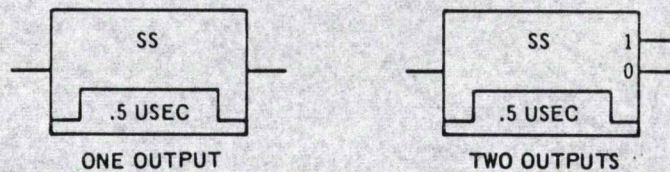
The AMPLIFIER symbol is



and as an INVERTER is



The SINGLE SHOT function is





Additional information on logic symbols can be found in MIL-STD-806B and MSFC-STD-353.

Boolean algebra describes the two values (0, 1) of the binary numbers system which is used for logic equations.

The AND function is designated by "." and the OR function by "+". The NOT function is represented by a bar over the variable "A". The basic laws, theorems, and identities of Boolean algebra are as follows:

$$A+B = B+A$$

$$A \cdot B = B \cdot A$$

$$A+(B+C) = (A+B)+C$$

$$A \cdot (B \cdot C) = (A \cdot B) \cdot C$$

$$A \cdot (B+C) = A \cdot B + A \cdot C$$

$$A+A = A$$

$$A \cdot A = A$$

$$0+A = A$$

$$0 \cdot A = 0$$

$$1+A = 1$$

$$1 \cdot A = A$$

$$A+\bar{A} = 1$$

$$A \cdot \bar{A} = 0$$

$$\text{if } A+B = C$$

$$\text{then } \bar{A} \cdot \bar{B} = \bar{C}$$

$$\text{and } A+B = \overline{(\bar{A} \cdot \bar{B})}$$

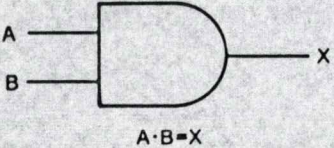
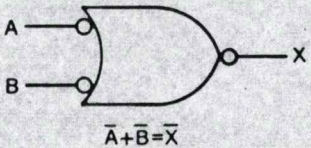
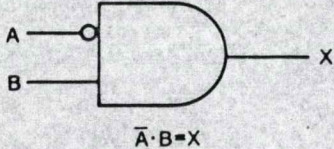
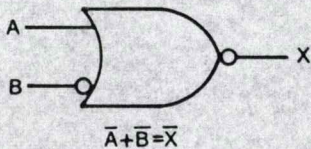
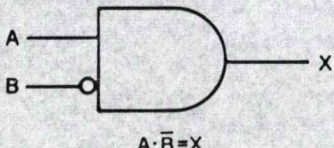
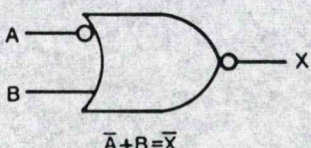
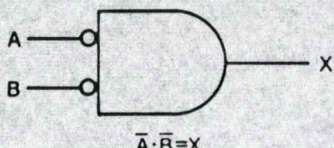
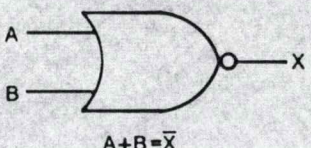
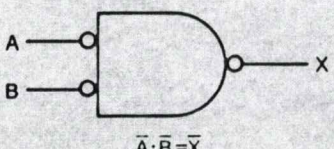
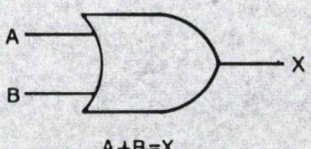
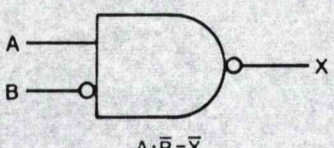
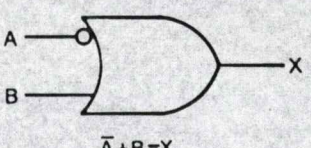
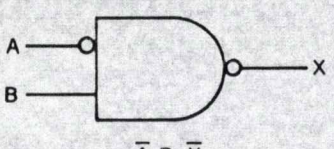
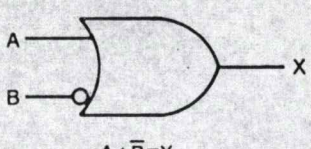
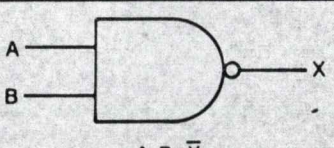
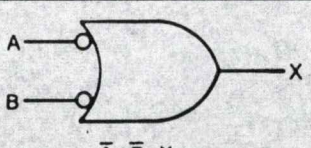
$$\overline{A \cdot B} = \bar{A} + \bar{B}$$

$$\overline{A+B} = \bar{A} \cdot \bar{B}$$

$$\overline{\bar{A}} = A$$



The relation between the logic symbols and Boolean algebra equations and the logic value of the functions AND, OR, and NOT is shown below:

AND	OR	A	B	X
 $A \cdot B = X$	 $\bar{A} + \bar{B} = \bar{X}$	H	H	H
		H	L	L
		L	H	L
		L	L	L
 $\bar{A} \cdot B = X$	 $\bar{A} + \bar{B} = \bar{X}$	H	H	L
		H	L	L
		L	H	L
		L	L	L
 $A \cdot \bar{B} = X$	 $\bar{A} + B = \bar{X}$	H	H	L
		H	L	L
		L	H	L
		L	L	L
 $\bar{A} \cdot \bar{B} = X$	 $A + B = \bar{X}$	H	H	L
		H	L	L
		L	H	L
		L	L	H
 $\bar{A} \cdot B = \bar{X}$	 $A + B = X$	H	H	H
		H	L	L
		L	H	L
		L	L	L
 $A \cdot \bar{B} = \bar{X}$	 $\bar{A} + B = X$	H	H	L
		H	L	L
		L	H	L
		L	L	H
 $\bar{A} \cdot B = \bar{X}$	 $A + \bar{B} = X$	H	H	L
		H	L	L
		L	H	L
		L	L	H
 $A \cdot B = \bar{X}$	 $\bar{A} + \bar{B} = X$	H	H	L
		H	L	L
		L	H	L
		L	L	H