

3.3.3 MICROPROCESSOR circuitry (μ P)

- Introduction

The ScopeMeter is controlled by a single chip microcomputer with on-board ROM (called Mask ROM in the following text). This microprocessor controls the total system operation and communication between the ScopeMeter and the outside world (key pad, RS-232-C interface). It also controls the communication between the internal system components.

- Detailed circuit description

See figure 3.2 and circuit diagram A1 (figure 10.2).

The ScopeMeter uses an Intel 83C196 microprocessor D1201, with on-board Mask-programmed ROM (Mask ROM). This microprocessor has an 8-bit data bus and a 16-bit address bus. The lower 8 address bits A0...A7 are combined with the data bits (multiplexed data bus). ADDRESS LATCH D1210 is used to separate data bits and address bits.

The microprocessor's Mask ROM contains the startup software and a diagnostic kernel test (see chapter 7). It also contains the software necessary to drive the serial interface and to clear and program the Flash ROMs.

The two Flash ROMs (FROMs) D1207 and D1208 contain the system software. The FROMs are directly connected to the microprocessor via the data and address busses. The microprocessor addresses the RAMs via the D-ASIC (D1203).

The microprocessor contains five 8-bit I/O ports. Port 3 and 4 share their bits with the data and address busses. The other I/O ports 0, 1, 2 are used for various purposes. For example: reading the keypad, operating the RS-232-C interface, battery voltage sense, switching the power on/off, etc.

Keypad circuitry

The keypad circuitry consists of five shift registers, D1601...D1606, each of which has eight inputs. These inputs are normally kept "high" by 56 K Ω resistor arrays connected to the +5V supply voltage. Whenever a key on the keypad is pressed, the corresponding line is connected to ground, resulting in a "low" signal. All signals are clocked into the shift registers (with the FRONT_CLOCK and FRONT_LATCH signals). Then they are converted into two signals FRONT_DATA1 (shift registers D1603, D1604, D1606) and FRONT_DATA2 (D1601 and D1602).

Optically isolated RS-232-C interface

The serial communications circuitry, which is built into the microprocessor, is used to operate the infrared (IR) RECEIVER and TRANSMITTER of the ScopeMeter. For this purpose a stripped version of the RS-232-C protocol is used.

Only the TXD (transmit data) and RXD (receive data) lines from the RS-232-C standard are used. The IR transmitter LED H1201 is driven directly from the TXD-not pin of the microprocessor. If a "0" is transmitted, the LED lights.

The IR receiver uses operational amplifier N1301 to power the collector of phototransistor H1202. If any IR light is received, the phototransistor will drive V1207 in saturation. This results in a "low" RXD line, interpreted by the microprocessor as a "1".

Battery sense circuitry

The battery voltage -VBAT generated on the analog unit is amplified by -2/3 at operational amplifier N1301. The resulting signal BAT_LEVEL is connected to an A/D converter input of the microprocessor. In this way the microprocessor can monitor the battery voltage level. If the battery voltage level drops below 4.4V, the microprocessor generates the BATTERY LOW indication on the LCD.