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KODEN

OPERATION MANUAL

DRILLING MONITOR

DM-602/604

This product is specifically desingned to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.

Printed in Japan

MD-602/604.OM.E 0093170152-06

Amendment History

DM-602/604 Operation Manual
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4	93170152 - 04	04/11/18	Chapter3 3.5 Figure 2.1
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Amendment policy

When any change is applied in the document, only the document number of the relevant sheet(s) and cover sheet are modified and the rest of the sheets are not changed. The document number is shown in the footer area, right or left bottom of each sheet.

Preface

Safety Precautions

- **High Voltage**

High voltages are used in the transmitter section which could be life threatening. A protection cover with the words **Danger High Voltage** is provided in this section but wait 10 minutes before inspecting inside.
Even if the power switch is turned off, residual voltages may remain in the capacitors inside the unit. Before inspection or replacement of parts, discharge this residual voltage in a safe and correct manner.

- **Disconnect Main Power**

It is still possible to receive an electric shock caused by unintentionally switching on the power during repair work. To prevent this from happening, make sure to completely disconnect the unit from the main supply before attempting any inspection.

- **Dust**

Dust can accumulate inside after long periods of use. Allergies can result from the inhalation of this dust, therefore during inspection and cleaning it is advisable to use a mask.

- **Static Electricity**

Static sensitive semiconductor devices are used in this unit. Before changing the printed boards be careful not to damage any of these devices due to electrostatic build up from carpet, clothes, seats, etc.

Symbols used in this manual

The following symbols are used in this manual. You are requested to be fully aware of the meaning of each symbol before carrying out inspection and maintenance of this equipment.

Alarm mark

Alarm

To handle the equipment ignoring this sign may lead to injury to the human body or damage to the equipment.

Caution mark

Caution

To handle the equipment ignoring this sign may lead to a malfunction of the equipment.

Warning High Voltage mark

To handle the equipment ignoring this sign may lead to electrical shock to the human body.

Prohibition mark

This sign indicates that a specified action is prohibited. The prohibited action will be shown in the vicinity of the mark.

How to use this manual

Scope of this manual

This manual contains information about installation, operation and maintenance of the Drilling Monitor DM-602/604.

Structure of this manual

This manual is divided into sections according to the contents as described below. This arrangement will help you overview the whole of the contents as well as refer to detailed information for your specific requirement.

Chapter 1: General Descriptions

- General feature of the equipment
- Applicable standard
- Equipment configuration
- Software type name

Chapter 2: Equipment Composition

- Standard equipment list
- Spare parts list

Chapter 3: Technical Specification

- Electrical and mechanical specifications
- Power requirements
- Serial data type name and available sentences
- Environmental conditions
- Dimensions and weight

Chapter 4: Installation

- Installation
- Unpacking and inspection of the goods
- Selecting the installation site
- Cable routing and wirings
- Installation of the Recording unit and Winch unit
- Adjustment after installation

Chapter 5 : Operational Descrptions

- Operating panel layout
- Operating controls
- Various setting instructions
- Record interpretation
- Operational check
- Replacement procedures for stylus and recording paper

Chapter 6: Using the Menu (Operational instructions)

- Getting started
- Using menus
- Time stamp
- Hole numbering
- Depth 0 correction
- Maintenance menu

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- Recorder unit
- First line inspection by the user

Chapter 8: Trouble Shooting and Repair

- Information required for service
- Possible causes of faults
- Diagnosis on specific phenomena
- Sensitivity check in the air
- Testing Recorder unit

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- RS 232C serial data output specification
- Hole No. data format
- Measurement data format
- RS 232C output pinouts (D-sub)

Chapter 1

General Descriptions

Contents

Chapter 1 General Descriptions

1.1 Outline of the equipment

Recent progress and development in foundation engineering has resulted in great strides in excavation techniques. As a result, deeper excavation is possible using artificial slurry of high density and specific gravity. The DM-602/604 series Drilling Monitor has been developed in order to fulfill the user's needs that are arisen from the recent construction environment to accurately measure and record the shape of a drilled hole of greater depth. The DM-602/604 series has the following features that benefit the user.

- The DM-602/604 supplies clear records of a drilled hole even in dirt use of high density and high specific gravity of 1.2 or the like.
- Measuring directions of X-X' and Y-Y' can be easily changed by a switch. (For DM-602 only)
- Measurements for X-X' and Y-Y' can be made at the same time. (For DM-604 only)
- The DM-602/604 supplies clear and precise records thanks to its unique signal processing technique that discriminates wall echoes from the noise.
- The DM-602/604 has the facility to cancel the oscillation line echo that often prevents very close echo recordings.
- The sensor device suspended from the winch is automatically controlled to stop at the casing and at the bottom of the hole. An emergency return function is also included.
- Depth range mark, depth mark, drilled hole mark, date, time, etc. can be printed on the recording paper.
- Limit switches are provided to avoid possible wire breakage or entanglement of the wire and cable.
- The recorded result can be supplied to an external PC via a built-in RS 232C output port.
- A non-fuse circuit breaker is used for circuit protection, eliminating the need for cumbersome fuse replacement at the construction site.

1.2 Applicable standards

The DM-602/604 series of Drilling Monitor is fully compliant with the technical requirements of ECC Mechanical Directive 89/392/EEC ANNEX I (98/44/EEC).

1.3 System configuration

The DM-602/604 series is configured as shown in Table 1.1 and Figure 1.1.

Table 1.1 The system configuration of DM-602/604

Model name	Recorder unit	Winch unit	Remarks
DM-602	DMR-602	DMW-001A	For 2-directional measurement
DM-604	DMR-604	DMW-002A	For 4-directional measurement

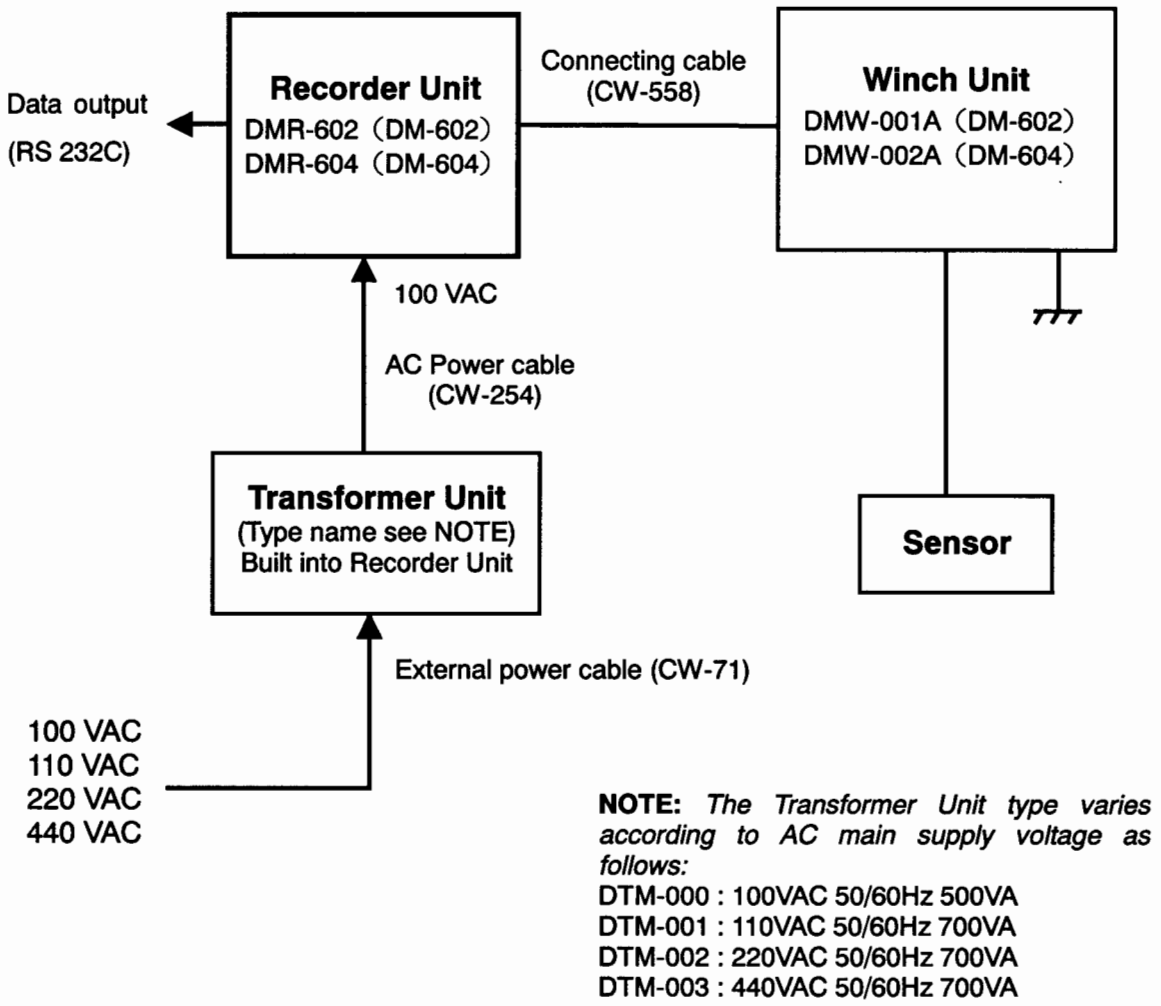


Figure 1.1 DM-602/604 system configuration

Chapter 2

Equipment Composition

Contents

Chapter 2 Equipment Composition

2.1 Standard equipment list

No	Item name	Type name	Remarks	Weight/Length	Q'ty
1	Recorder unit	DMR-602(DM-602) DMR-604(DM-604)	Contained in an aluminum case. ● With DMT-000/001/002 built-in ● With DMT-003 built in	 57kg 59 kg	1
2	Transformer unit (Built into Recorder Unit)	DMT-000	For AC100V supply, contained in an aluminum case		1
		DMT-001	For AC110V supply, contained in an aluminum case		
		DMT-002	For AC220V supply, contained in an aluminum case		
		DMT-003	For AC440V supply, contained in an aluminum case		
3	Winch unit	DMW-001A(DM-602) DMW-002A(DM-604)	With a sensor unit and a sensor cable	121kg	1
4	Connecting cable	CW-558	A 15 pin connector on both ends	10m	1
5	AC Power cable	CW-71	A 3 pin connector on one end and fly leads on the other end	10m	1
6	Spare parts		Contained in an aluminum case		1 set
7	Operation manual		Common use for DM-602 and 604		1
8	Operating card	For DM-602	Contained in an aluminum case		1
		For DM-604	Contained in an aluminum case		

2.2 Spare parts list

No	Item name	Type name	Remarks	Q'ty
1	Recording paper	DMP-250	250mm×20m (A3-560)	2
2	Recording stylus	DMS-001	Contained in a PVC bag	2
3	Current feed stylus	DMS-002	Contained in a PVC bag	2

Chapter 3

Technical Specification

Contents

Chapter 3 Technical Specification

3.1 Technical specification

This specification is subject to change without notice for possible alteration of components parts specification and relevant technical standards as well as customer's requirements.

Recorder Unit

Model name			DM-602 (For 2 directional measurement) DM-604 (For 4 directional measurement)			
Measuring method			By ultrasonic pulse transmission and reception			
Recording method	DM-602		Linear recording by using the belt		Measurement by 2-irectional switching	
	DM-604				Simultaneous 4directional (X-X', Y-Y') measurement	
Recording paper			Electro-sensitive type, (DMP-250 A3-560)			
Transmitting frequency			88kHz			
Transmitting output			5W			
Beam angle			25° (Measured at half-power point)			
Pulse Repetition Rate (PRR)			15.000 times/min maximum at 0.5m range			
Measuring range (Radius)	Range		0.5 m	1 m	2 m	4 m
	Shift 0%		0 - 0.5 m	0 – 1 m	0 – 2 m	0 – 4 m
	Shift 50%		0.25 - 0.75 m	0.5 - 1.5 m	1 – 3 m	2 – 6 m
	Shift 100%		0.5 – 1 m	1 – 2 m	2 – 4 m	4 – 8 m
Paper speed	Constant		7.5 mm/min	15 mm/min	30 mm/min	60 mm/min
	Depth-proportional	1/40	25mm/m (unit excursion length of the sensor unit)			
		1/50	20mm/m			
		1/100	10mm/ 1m			
		1/200	5mm/ 1m			
Measurement accuracy			+/- 2%, F.S.			
Depth mark			Marks printed every 1m, numerals every 5m automatically			
Power protection circuit			Non-fuse breaker (2A, 8A), Leakage breaker (20A), Over-voltage protection circuit			
Power supply			AC100V 50/60Hz	AC110V 50/60Hz	AC220V 50/60Hz	AC440V 50/60Hz
Power consumption (Nominal)			Approx 500 VA	Approx 700VA	Approx 700VA	Approx 700 VA
Operating temperature			-10°C - +50°C			

Winch Unit

Transgress speed	0 - 20m/min, continuously variable
Maximum transgress depth	100m
Bottom and casing arrival detection	By a limit switch
Operating temperature	-10°C to +50°C

3.2 Serial data output

Type: RS-232C

Sentence name: DM, DT

3.3 Power requirements

Input voltage and power consumption:

100VAC / 500VA Nominal

110VAC / 700VA Nominal

220VAC / 700VA Nominal

440VAC / 700VA Nominal

3.4 Environmental conditions

Operating temperature:	-10 °C to +50 °C
Storage temperature (High end):	+70 °C
Humidity:	93 ±3 % at +40 °C

3.5 External dimensions and weight

3.5.1 Recorder unit

Dimensions: 740 mm (Width) x 465 mm (Depth) x 465mm (Hight)

Weight: 57 kg (For 100/110/220 VAC

59 kg (For 440 VAC)

3.5.2 Winch unit

Dimensions: 1050 mm (Width) x 660 mm (Depth) x 750 mm (Hight)

Weight: 121 kg

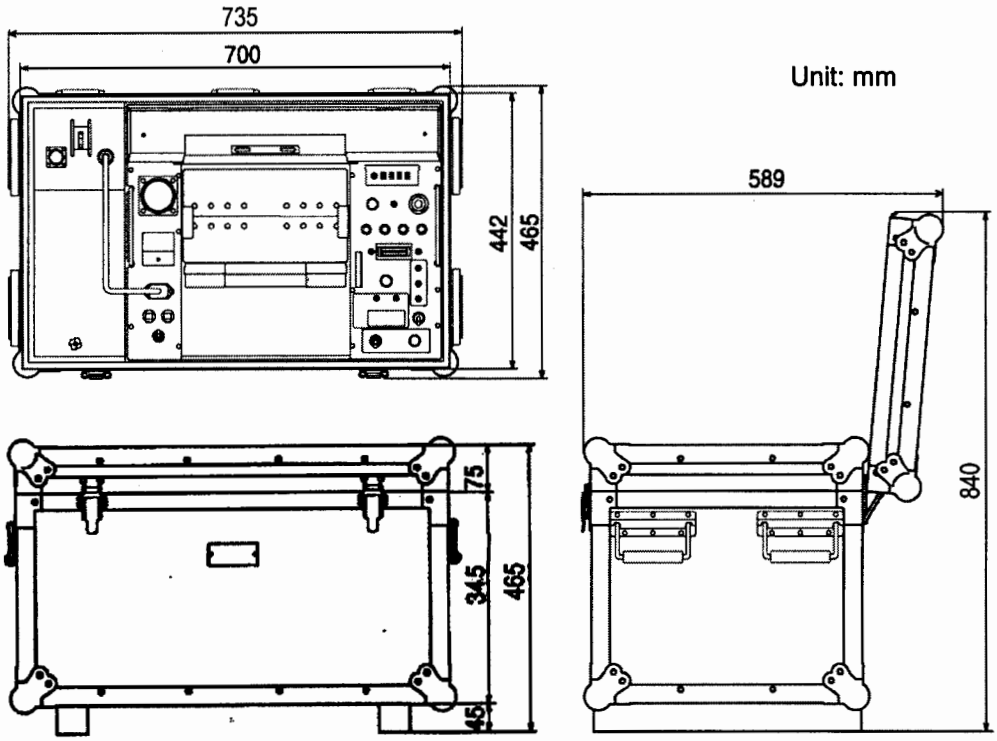


Figure 2.1 Outline drawings of Recorder unit

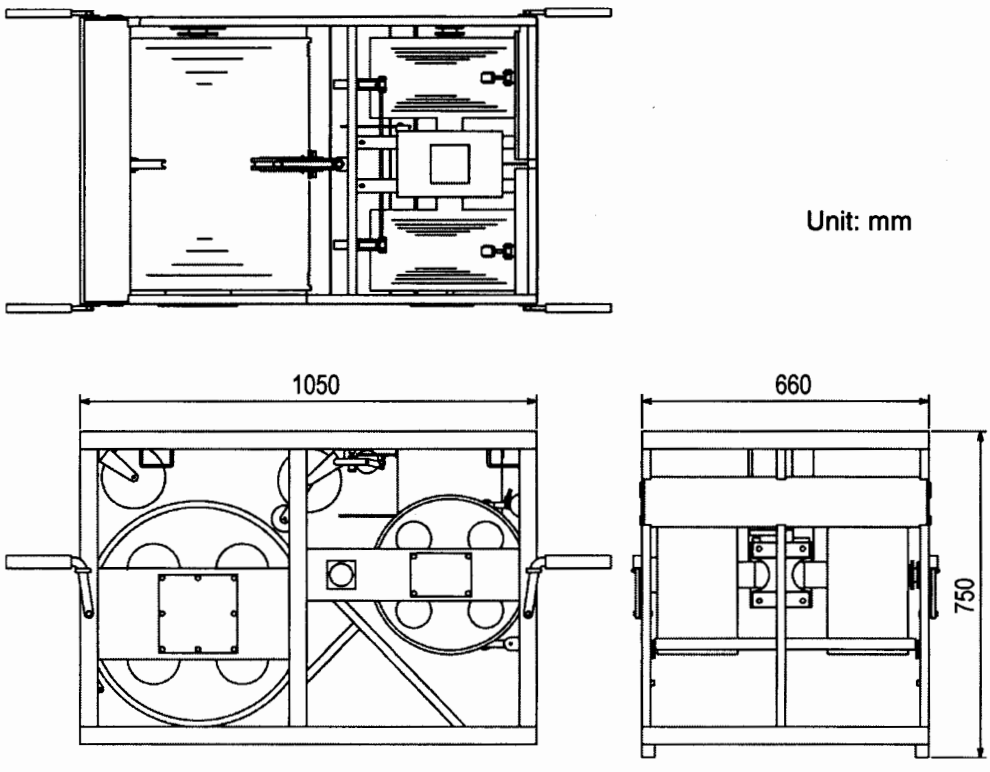
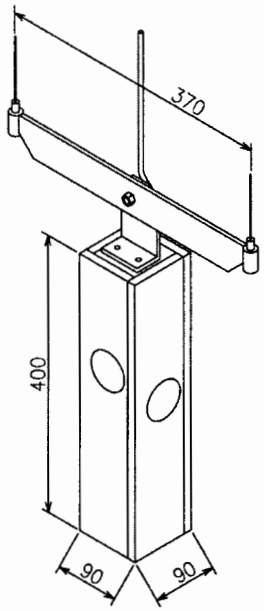


Figure 2.2 Outline drawings of Winch unit



Unit: mm

Figure 2.3 Outline drawing of Sensor unit

Chapter 4

Installation

Contents

Chapter 4 Installation

4.1 Installation considerations

General

Qualified service personnel should perform the installation of the DM-602/604 series of Drilling Monitor. The installation comprises the following operations.

(1) Unpacking each component of the system.
(2) Inspection of the exterior of each component unit and accessory.
(3) Checking the main power supply voltage and current capacity.
(4) Installing the Winch unit and Recorder unit
(5) Commissioning

4.2 Unpacking each component of the system

Unpack your package and check if all of the items stated in the packing list are contained in the package. If not, report this to the insurance agent for tracing missing goods or refund.

4.3 Inspection of each component unit and accessories

Carefully check the exterior of each component unit for dents, damage, etc. Also check the inside of component units for electrical and mechanical damages.

4.4 Siting the unit

4.4.1 Recorder unit

(1) The Recorder unit must be installed on a flat surface, which is protected from rain and splash.
(2) The Recorder unit must be positioned away from power cables to avoid possible malfunction of electronics inside of the unit.

4.4.2 Winch unit

The Winch unit must be installed level with the ground over the center of the excavated hole.

4.5 Cable layout and connection

4.5.1 Connecting the control cable

Before connecting the control cable, make sure the POWER switch has been switched off. Connect the cable to each unit firmly. Make sure that both plugs and sockets are free from dust, sand, condensation, etc. that could cause short circuit and poor contacts within the connectors. When attempting to remove the cable, turn the POWER switch off first.

4.5.2 Connecting the Power cable

4.5.2.1 AC100V cable

(1) Make sure, before connecting the cable, that the POWER switch is turned off and the WINCH UP/DOWN SPEED control switch is set to OFF position.

(2) Connect the AC 100V cable to the EXT POWER INPUT connector on the Transformer unit.

(3) Confirm that the POWER meter reads a voltage ranging from 90 VAC to 110 VAC.

Warning

⚠ When an input voltage deviates from the rated range, the operation of DM-602/604 will be stopped automatically for protection. In such a case:

(1) Turn the POWER switch off and disconnect the power cable from the Recorder unit.

(2) Set the main supply voltage to be within the rated voltage, reconnect the cable, and then turn the unit on.

4.5.2.2 Connecting the External Power cable

(1) Connect the External Power cable to the POWER input connector. Insert the connector firmly and fasten it to the panel using two fixing screws.

(2) Connect the other end of the cable to a power distribution terminal board, according to the instruction in Figure 4.1.

White: AC
Black: AC (Common)
Green: GND
Red: Spare

Figure 4.1 Dressing External Power cable

Warning

⚠ Improper grounding may result in electrical shock to the human body. Make sure that the unit is securely grounded.

4.6 Installing the Recorder unit

The Recorder unit must be placed level with the ground and protected from splash or rain. If required, use a PVC cover for drip protection.

4.7 Siting the Winch unit

(1) Put two retainer wooden beams over the mouth of the casing pipe or on the guide wall, as shown in Figure 4.2 or Figure 4.3.

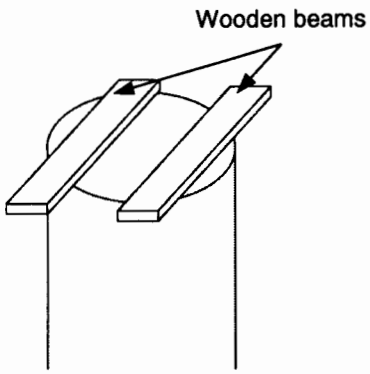


Figure 4.2 Wooden beams on a Casing Pipe

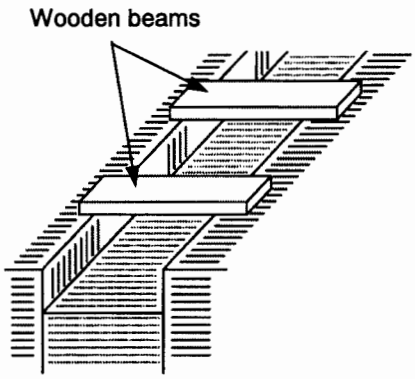


Figure 4.3 Wooden beams on a Guide Wall

(2) Release the strap that fastens the sensor unit and the hanger in the Winch unit.

(3) Move the Winch unit and place it on the retainer plates.

NOTE: When carrying the Winch unit, use the handles attached on each corner of the unit as shown in Figure 4.4. When the Winch unit is to be hoisted by a crane, hook a shackle on the designated part on each corner of the Winch unit frame. During transportation, use utmost care not to apply excess force against the unit especially when hoisting up or down.

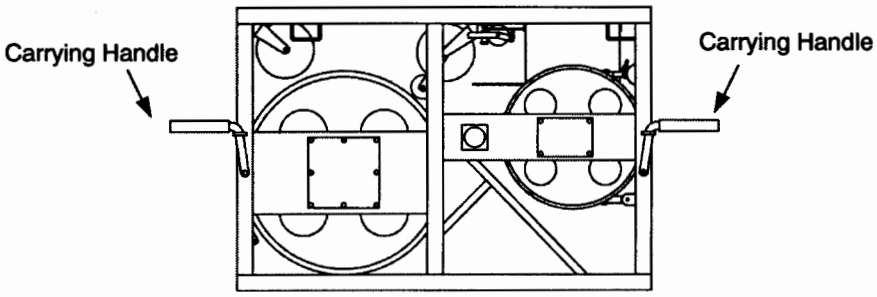


Figure 4.4 Location of carrying handle

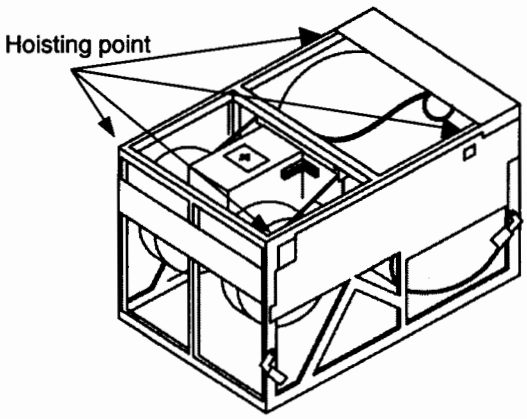
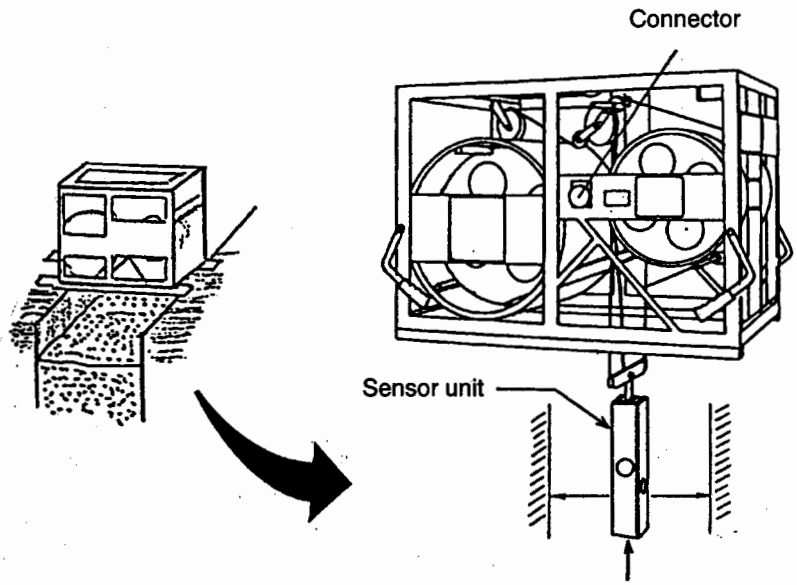


Figure 4.5 Hoisting points designated on Winch unit

NOTE: Make sure the Winch unit sits level with the ground in order to allow the sensor unit to be hoisted vertically.



The sensor unit must be arranged so that it travels in line with the hole's vertical axis.

Figure 4.6 Hoisting the Sensor unit

4.8 Check after the installation

Before operating the DM-602/604 Drilling monitor, make sure the following conditions are met. If not, take necessary measures.

1. Is the unit's main supply voltage within the rated range?
2. Are cable connections done correctly and properly?

Chapter 5

Operational Descriptions

Contents

Chapter 5 Operational Descriptions

5.1 Locations of controls and switches

5.1.1 Recorder unit

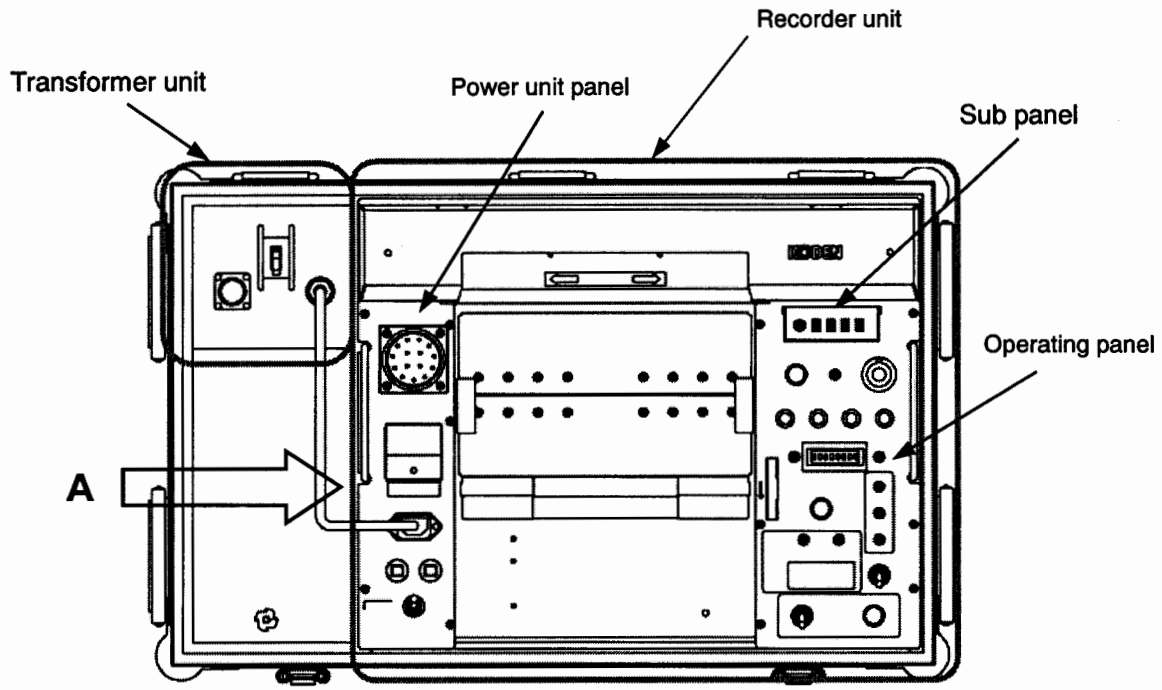


Figure 5.1 Main operating panels on Recorder unit

Seen from "A"

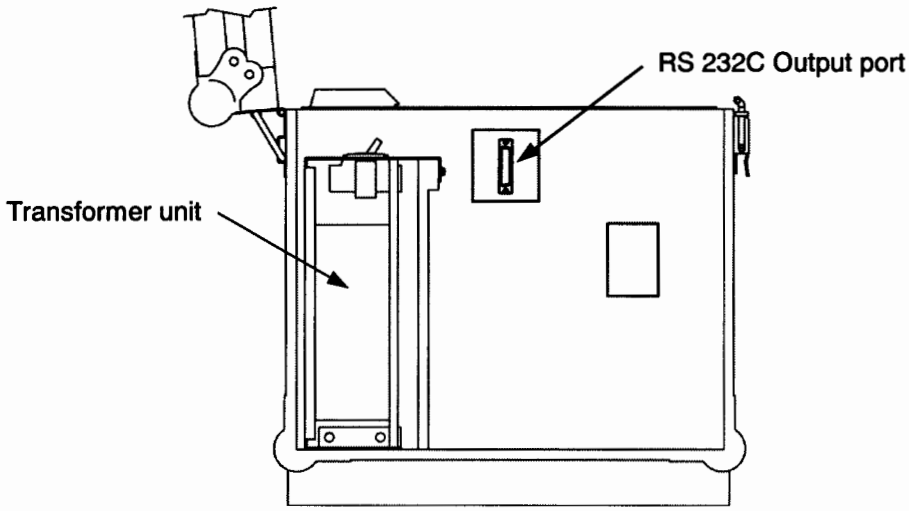


Figure 5.2 Location of RS 232C output port

5.1.2 Winch unit

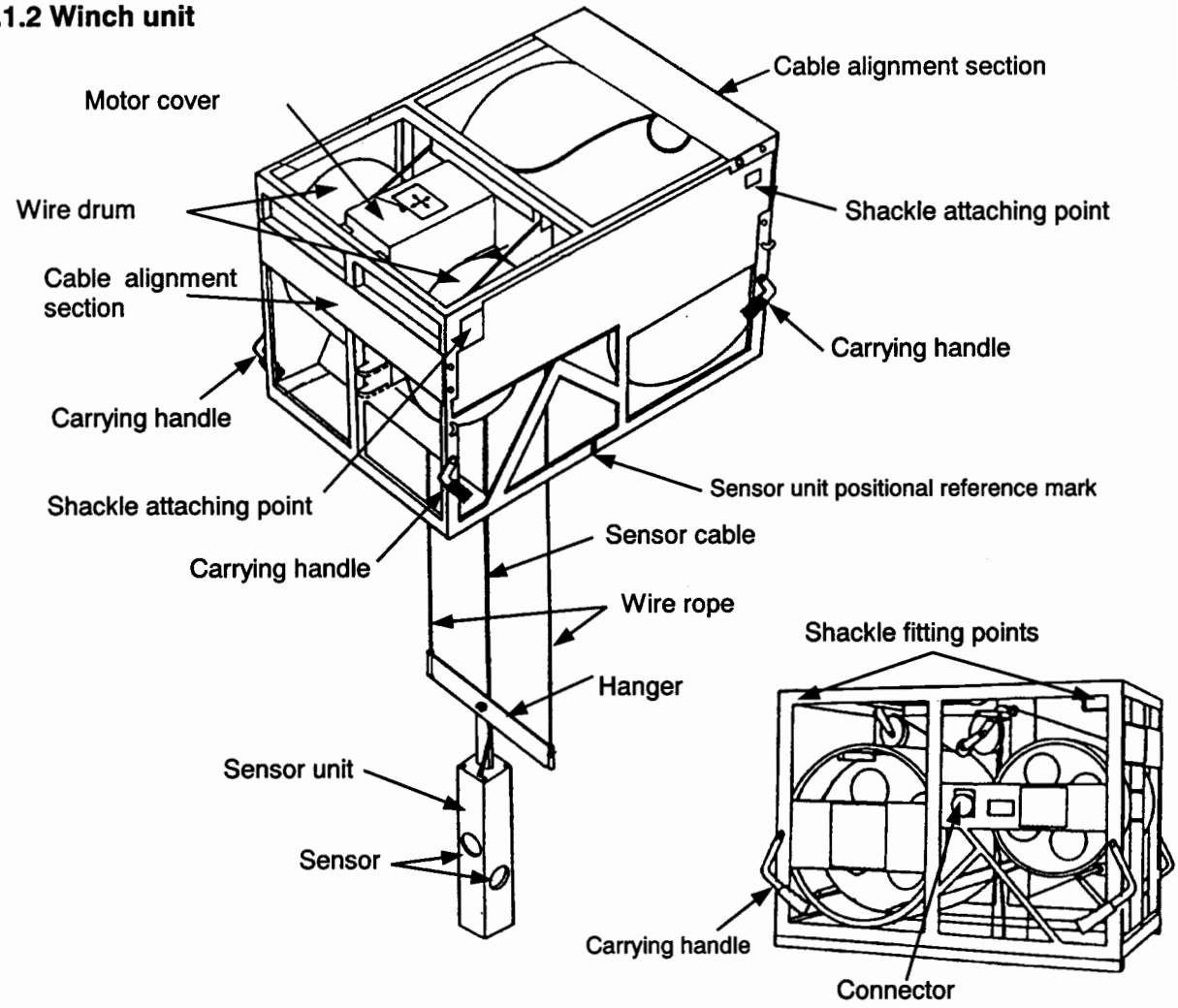


Figure 5.3 Exterior of Winch unit

5.2 Functions of controls and switches

5.2.1 Transformer unit panel

5.2.1.1 Power switch

This is the main power switch with a circuit breaker built in, which is provided in the primary winding side of the Transformer. This switch turns on and off the main power supply to the entire system.

5.2.1.2 External power input connector

This is the Power connector from which external AC main supply is supplied. The applicable input power supplies are 100 VAC, 110 VAC, 220 VAC and 440 VAC.

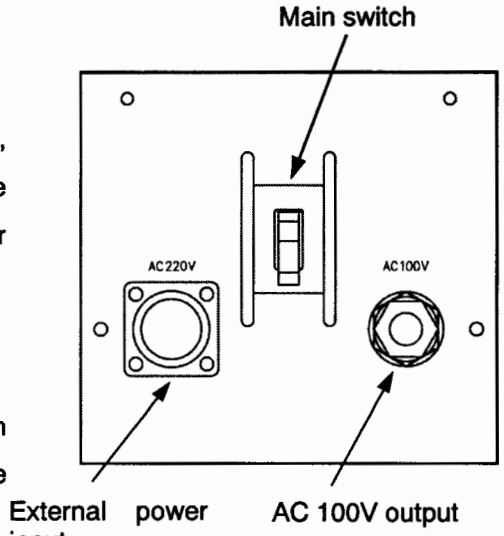


Figure 5.4 Transformer unit

5.2.1.3 100 VAC output cable

This is the power supply cable, which is connected to the POWER connector on the Power panel of Winch unit.

5.2.2 Power panel

On this panel, primary power supply and winch unit are connected. Also provided are Power meter, circuit breakers and the recorder power switch.

5.2.2.1 WINCH connector

This is a connector to which the cable from the Winch unit is connected.

5.2.2.2 AC 100 V meter

This meter indicates the input power voltage (100 VAC) to the Winch unit.

5.2.2.3 Power connector

This is a connector to which the 100 VAC input is supplied.

5.2.2.4 Circuit breaker for Recorder unit

This is an over-current breaker for Receiver unit. In case an excess current over 2 amps flows, this breaker is activated to cut off the main supply automatically.

5.2.2.5 Circuit breaker for Winch unit

This is an over-current protector for the sensor unit transverse control circuit. The circuit breaker will be activated when the load current exceeds 8 amps.

5.2.2.6 RECORDER POWER switch

This switch turns on and off the main power supply to the Recorder unit.

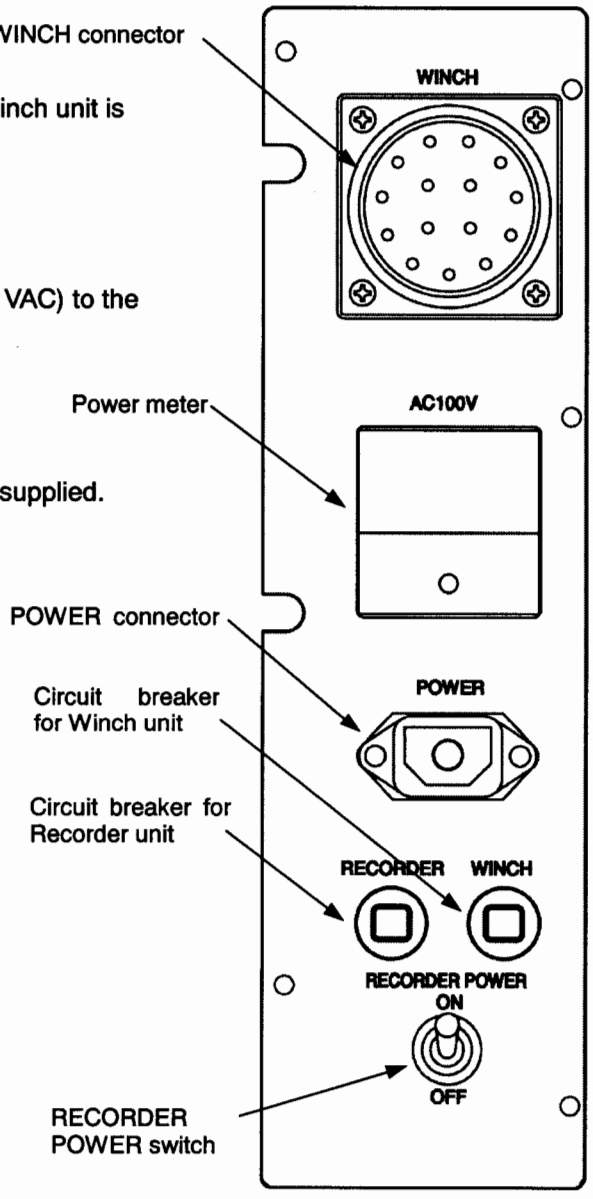


Figure 5.5 POWER panel

5.2.3 DM-602 Operating panel

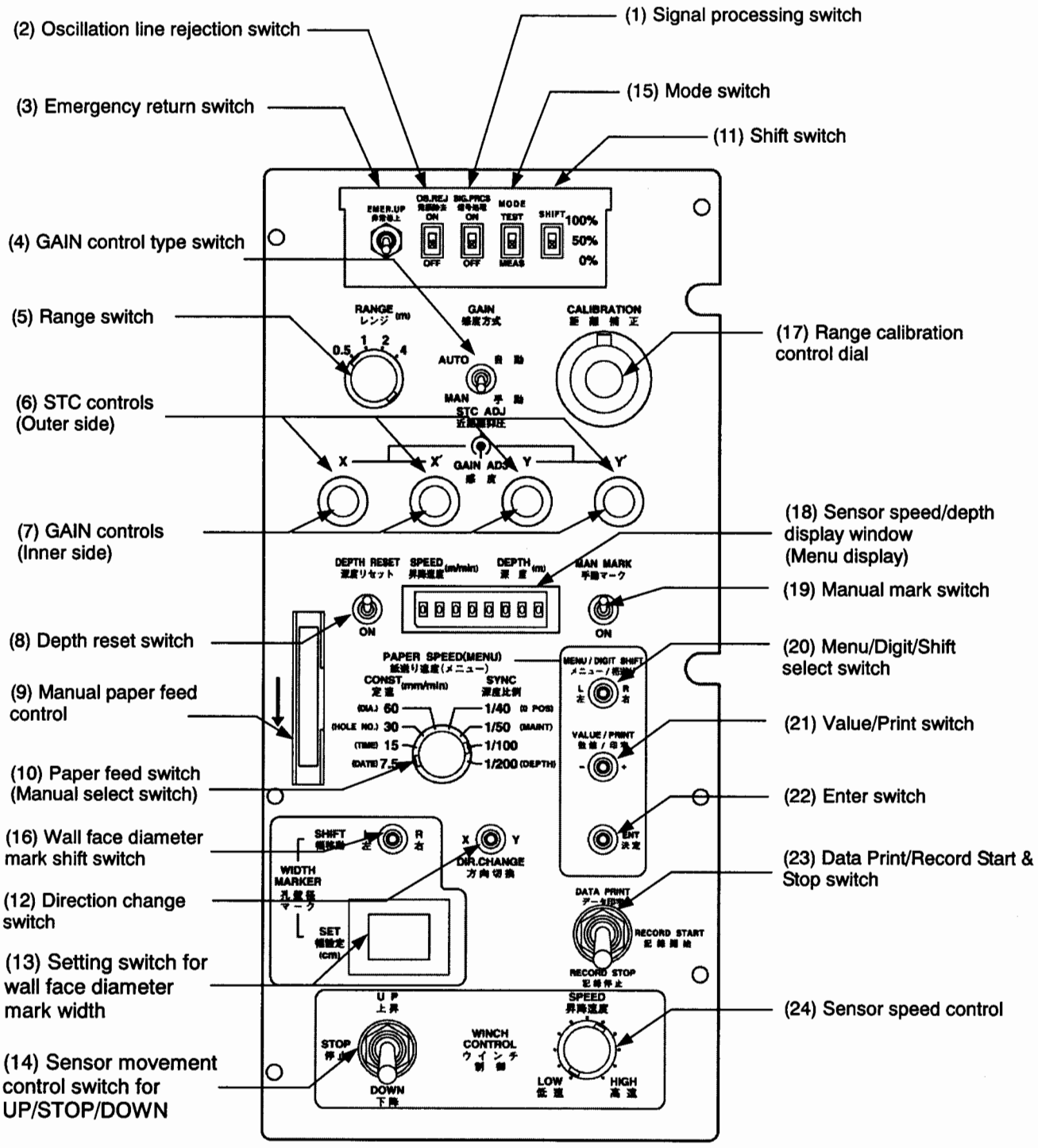


Figure 5.6 DM-602 control panel

5.2.3.1 SIG. PRCS switch (1)

Turns on and off the signal processing function. When turned on, the wall face echoes will be enhanced for better recognition.

5.2.3.2 OS. REJ switch (2)

When this switch is turned on, the oscillation line will be rejected yet nearby echoes are shown clearly.

5.2.3.3 EMER. UP switch (3)

In case of an emergency, use this switch to wind up the sensor unit.

5.2.3.4 GAIN switch (4)

This switch switches GAIN control type to AUTO (Automatic) or MAN (Manual) mode. When AUTO is selected, the receiver gain is expertly controlled to the best recording image.

5.2.3.5 RANGE (m) switch (5)

This switch changes the depth range (radius) for the measurement.

5.2.3.6 STC (Sensitivity Time Control) (6)

This control reduces unwanted echoes from the wall surface.

5.2.3.7 GAIN ADJ control (7)

When the manual GAIN control type is selected, this control becomes effective. Turning the control to the right increases the receiver gain and to the left decreases the gain.

5.2.3.8 DEPTH RESET switch (8)

When this switch is set to ON, the depth record is reset to 0 meters.

5.2.3.9 Manual paper feed control (9)

Turing this control to the direction indicated by an arrow feeds the paper manually.

5.2.3.10 PAPER SPEED (MENU) (10)

In normal operation, this switch functions as a paper speed change switch. The selectable modes are CONST (Constant) (mm/min) and SYNC (Depth proportional). When the Data print / Record start & stop switch is set to RECORD START, the recording paper can be fed in the following mode:

CONST(mm/min)

The recording paper is fed at a specified constant speed that is selected from 7.5 mm/min, 15 mm/min, 30 mm/min or 60 mm/min,

SYNC

The recording paper is fed at an specified speed that is proportional to the winch speed. The speed selections are 1/40, 1/50, 1/100 and 1/200 against the winch speed. During the menu display, this

switch functions as a menu change switch.

5.2.3.11 SHIFT switch (11)

This switch is used for moving the wall face diameter mark to the left or the right on the recording paper.

5.2.3.12 DIR. CHANGE switch (12)

This switch is used for changing the direction of the sensor unit during measurement.

5.2.3.13 SET swicth (13)

This switch is used for setting the width of the wall face diameter mark. A setting value is entered in cm and can be varied in the range of 000 cm to 999 cm.

5.2.3.14 UP/STOP/DOWN (14)

This switch is used for moving the sensor unit up, down or setting to stop. This function is operable whether the recorder unit is running or not. However, when data printing is in process, this switch is kept disabled even if it is set to up or down.

5.2.3.15 MODE (TEST/MEAS) switch (15)

This switch is used for changing the record mode. In normal operation, this switch must be set to MEAS. By setting this switch to TEST, a simulated echo image will be recorded.

5.2.3.16 SHIFT switch (16)

This switch is used for shifting the measuring range within the range scale in use. In normal operation, this switch must be set to 0 %.

5.2.3.17 CALIBRATION dial (17)

This dial is used for correcting the deviation of the measured distance to a true value.

5.2.3.18 Digital window, SPEED and DEPTH (18)

The sensor unit speed and depth are shown in this window. This window indication will be changed to the menu display during the menu setting and confirmation.

5.2.3.19 MAN MARK switch (19)

Holding and pressing this switch allows the manual mark to be printed on the recording paper.

5.2.3.20 MENU/DIGIT/SHIFT switch (20)

This switch is used for menu settings/confirmation as well as shifting the digit of a numeral.

5.2.3.21 VALUE/PRINT switch (21)

This switch is used for selecting alpha-numeric letters used in the initial setting or to set data printing ON or OFF.

5.2.3.22 ENT switch (22)

This switch is used for entering updated initial settings.

5.2.3.23 DATA PRINT / RECORD START & STOP switch (23)

This switch is used for data printing, record start and stop functions. The record start and stop functions are available even when the sensor is lifted up, down or stopped. The data printing function is available only when the sensor movement is stopped.

5.2.3.24 SPEED control (24)

This control adjusts the sensor transgress speed. Turning to the right increases the speed and to the left decreases the speed in the range of 0 to 20 m/min. In case the PAPER SPEED switch is set to SYNC, the available fastest speed per paper speed are as follows:

Paper speed	Sensor unit moving speed
1/40	4.8 m/min Max.
1/50	6.0 m/min Max
1/100	12 m/min
1/200	12 m/min

5.2.4 Wall face mark shift and set switches for DM-604

The operation panels of DM-602 and 604 are identical except the followng features.

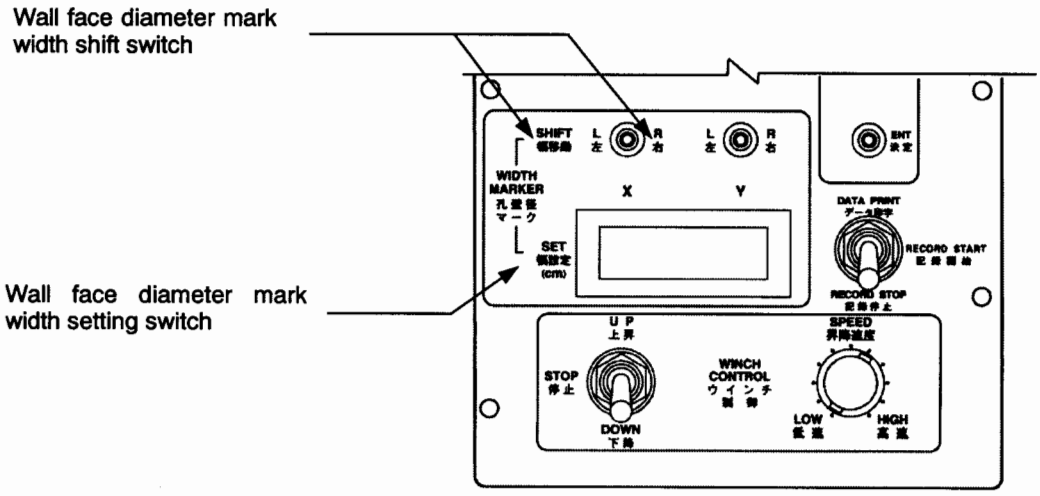


Figure 5.7 Wall face mark shift and set switches for DM-604

5.2.4.1 SHIFT switches for X and Y directions

These switches are ued for moving the wall face mark to the right or the left on the recording paper for X and Y directions independently.

5.2.4.2 SET X Y (cm) switch

This switch is made up of 2 sets of 3 digit digital switches, used for setting the width of the wall face diameter mark for X and Y directions. Values to be set are the diameter of the hall in cm, entered from 000 cm to 999 cm.

5.2.5 Measurement data output (Option)

The recorded result (numerical data of depth and the distance to the hole wall face) can be output to an external PC by using an optional connecting cable with a D-sub connector. Please contact KODEN or its local sales agent for detail.

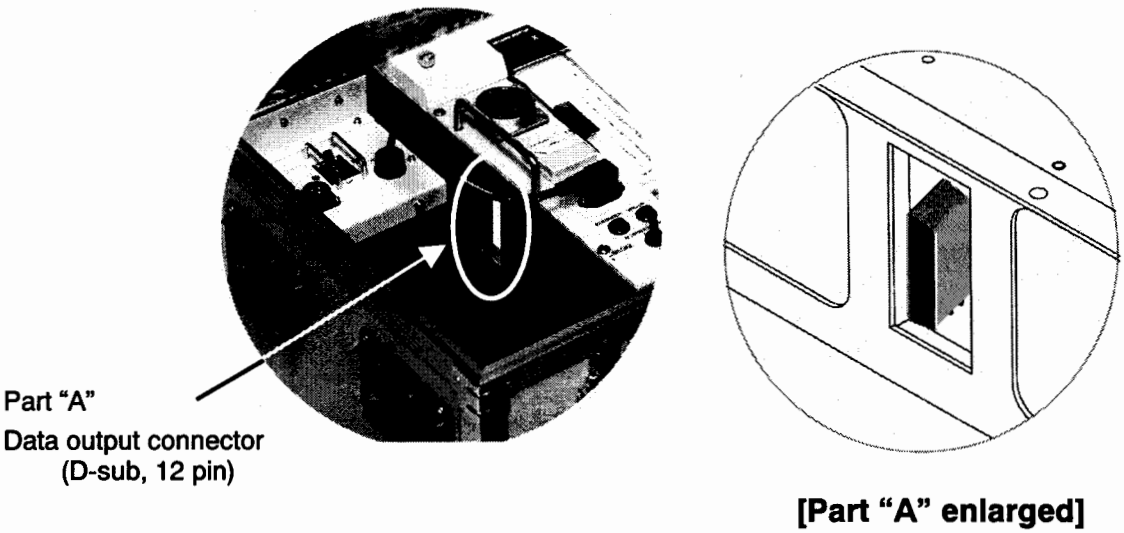


Figure 5.8 Data output port

5.3 Operating procedures

This paragraph describes the standard operating procedure for operating the DM-602/604 Drilling Monitor system.

5.3.1 Getting started

Turn on the Main switch on the Transformer Unit and then Recorder Power switch.

5.3.2 Setting the measurement range

To set up the measurement range, use the RANGE and SHIFT switches. The RANGE switch selects the maximum horizontal distance of the measurement for X, X', Y and Y' directions. The range selected should be larger than the diameter of the excavated hole. The SHIFT switch shifts

the starting point of the range measurement, in order to allow an extended range measurement beyond a center-fixed range scale. Available shift amounts are 50% and 100% of a fixed scale. In normal operation, the shift amount should be set to 0%.

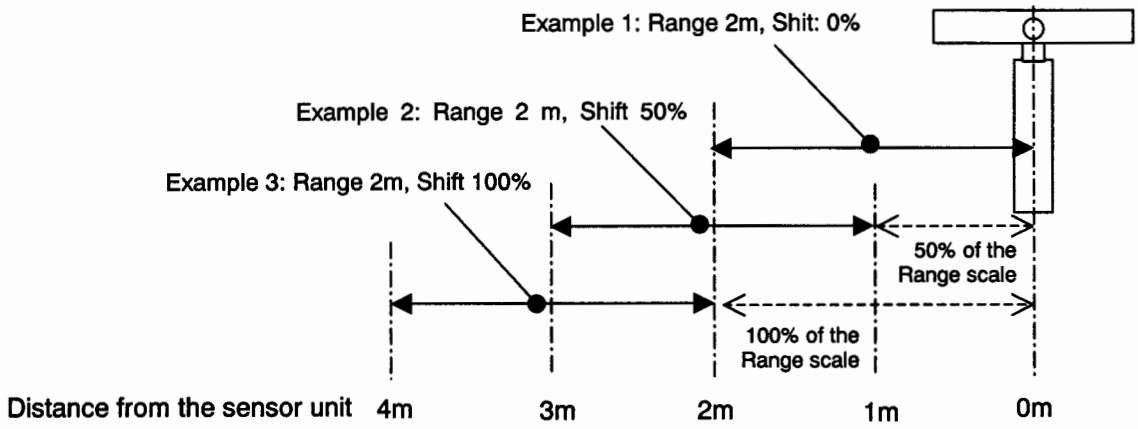


Figure 5.9 Shifting the range scale

5.3.3 Selecting the paper speed

There are two modes of speed control available, CONSTANT (mm/min) and SYNC.

CONSTANT (mm/min):

In this mode the paper is fed at a selected speed (paper length / minute), which is irrelevant to the sensor speed. The following speeds are available:

7.5 mm/min, 15 mm/min, 30 mm/min and 60 mm/min

SYNC

In this mode the paper feeding speed is controlled in proportion to the sensor's transgress speed, which is expressed as a ratio against the unit length (m) of sensor's transgress distance.

Table 5.1 SYNC speed vs paper length

SYNC speed (ratio against 1 meter)	Actual paper feeding length
1/40	25mm
1/50	20mm
1/100	10mm
1/200	5mm

5.3.4 Setting the measurement direction (DM-602 only)

Set the DIR. CHANGE switch to X or Y direction. If this switch is set to X, the measurement will be conducted for X-X' direction and, Y for Y-Y' direction.

5.3.5 Setting the width of the hole wall diameter mark

The wall diameter mark is a set of parallel dotted lines that indicate the wall's surface of an excavated hole. The center of the diameter mark is fixed to the center of the excavated hole. This feature is commonly provided in DM-602 and DM-604, however, the number of setting switches is different. For DM-602, there is only one switch that must be switched to X or Y for each direction. In DM-604 there are two dedicated switches for X and Y directions. To set:

For DM-602:

(1) Set the direction of the width mark to X or Y by the DIR. CHANGE switch.

(2) Enter the width of the mark in 3 digits by flipping the tab of the 3 digit digital switch. The unit is in cm.

For DM-604:

(1) Enter the width of the mark in 3 digit by flipping the tab of the 3 digit digital switch on X and Y directions. The unit is in cm.

⚠ Warning

In the following circumstances, the hole diameter mark will not be printed.

(1) The hole diameter mark width is set to 000.

(2) The hole diameter mark width is set out of the recording range.

5.3.6 Shifting the hole diameter mark width

By pressing the SHIFT switch to the right or the left, the hole diameter mark will shift to the right or the left. This function should be used when you need to align the hole diameter mark with the echoes of the casing or the guide wall.

Note

(1) For accurate measurement result, the sensor unit must be positioned in the center of the hole. The hole diameter mark switch should be used for fine positioning of the sensor.

(2) The hole diameter mark position will be reset to 0 (cm) when the system is re-powered.

5.3.7 Recording paper

The recording paper used must be genuine recording paper. Further, in case a red line appears on the paper, replace the recording paper with a new role. For replacement procedure, refer to para 5.6 "Replacing the recording paper".

5.3.8 Setting the winch speed

The winch speed can be adjusted by the SPEED control. Turning the control to the right increases the speed and to the left decreases the speed. Turning the control to the furthest left end causes the sensor unit movement to be suspended. The winch speed can be monitored at the SPEED indicator in the center of the panel. When the control is fully turned to the furthest right position,

the sensor unit moves at 20 m/min speed. However, when the SYNC mode is selected, the maximum speed is limited to the value shown in the following table.

Winch speed	Sensor unit
1/40	4.8 m/min max.
1/50	6.0 m/min max.
1/100	12 m/min max.
1/200	12 m/min

5.3.9 Moving and stopping the sensor unit

To move the sensor unit, set the sensor control unit towards the desired direction printed on the panel, UP or DOWN. To stop the sensor movement, set the switch to STOP. The following notes for switch modes should be taken before operating this switch.

UP: The sensor unit will be lifted up at the speed set by the SPEED control. However, the sensor unit movement will be suspended in the following conditions.

(1) When the data is printed. The sensor movement will restart as soon as the printing job is finished.

(2) When the sensor is stowed.

STOP: The sensor movement will be stopped irrelevant to the winch speed setting.

DOWN: The sensor unit will be lifted down at the speed set by the SPEED control. However, the sensor unit movement will be suspended in the following conditions.

(1) When the data is printed. The sensor movement will restart as soon as the printing job is finished.

(2) When the sensor reaches the bottom.

5.3.10 Recording and printing the data

The image recording and numeral measurement data printing can be performed by the Data print/Record start & Stop switch. Available modes of operation are as follows:

START: The driving belt starts to move and image recording is performed.

STOP: The driving belt stops and the recording is suspended.

DATA PRINT: The measurement data is printed. This function is available only when the sensor unit is stopped. During lifting up or down of the sensor unit, the data printing operation becomes ineffective. When data printing is in process, the winch control function will be suspended until printing job is completed. The following data can be printed:

Date. Time, hole number, hole diameter, measuring direction, depth scale and the bottom depth.

NOTE: The bottom data is printed when the sensor unit reaches the bottom. The date, time, hole number and hole diameter can be deleted from printing. (The rests cannot be deleted) For detail, refer to para 6.2.3, 6.3.2 and 6.4.2.

5.3.11 Setting gain control type

There are two types of gain control, AUTO and MAN. In AUTO mode, the receiver gain is automatically controlled to the best image. In MAN (Manual) mode, the operator can control the receiver gain. To switch the function, set GAIN switch to MAN or AUTO. In normal operation, set the switch to AUTO mode.

5.3.12 Gain control and STC

These controls are for the X, X', Y, Y' directions. The gain control function is in the center of the controls and the STC function is on the outer of the control.

GAIN controls:

Turning the GAIN control to the right increases the receiver gain and to the left decreases the gain. The gain control should be adjusted so that excavated hole walls are best defined on the recording paper without smear by unwanted echoes and background noise. In particular, in the measurement in a casing or a guide wall, the best setting should be such that the secondary echoes are faintly displayed yet the actual wall echoes are clearly shown.

STC controls:

The STC control reduces the gain near the sensor in a time (range) proportional manner, i.e the gain reduction is at maximum in the center of the recorded image and its effect reduces with time exponentially. By turning the STC to the right increases its effect, causing unwanted echoes near the oscillation line to be reduced. Take care not to over apply this effect otherwise wall echoes may be reduced or lost as well.

Recording examples:

[Example 1]

The following image example show how the oscillation line and wall surface echoes are not separated caused by excessive gain.

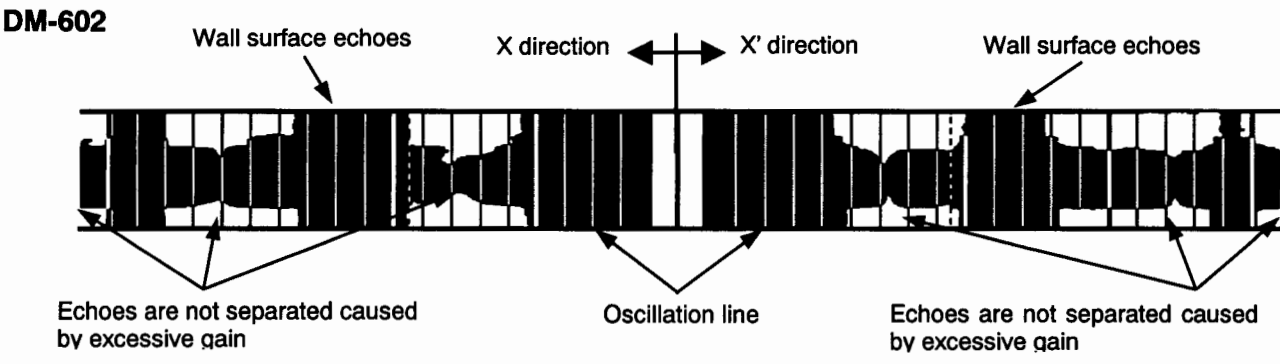


Figure 5.10 Recording example of DM-602 – Excessive gain

DM-604

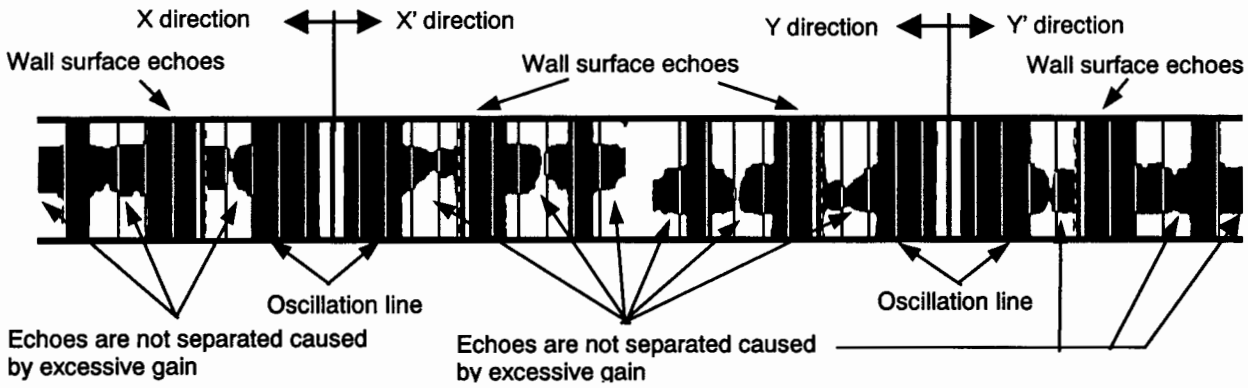


Figure 5.11 Recording example of DM-604 – Excessive gain

[Example 2]

The following image example shows when STC is applied improperly.

DM-602

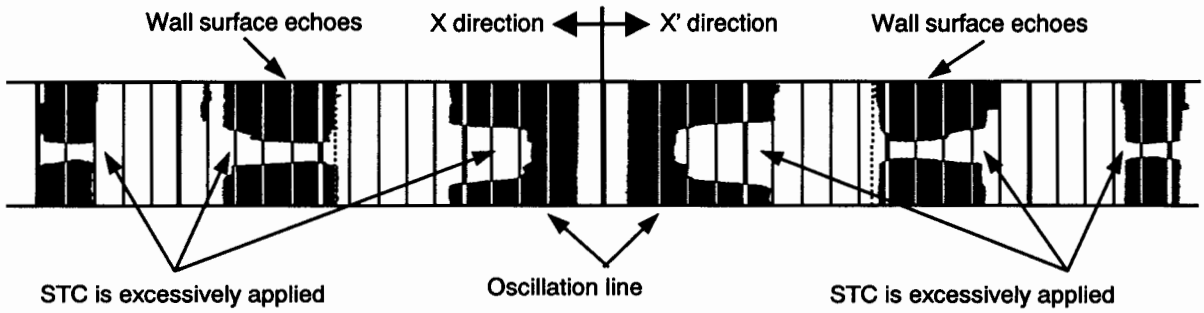


Figure 5.12 Recording example of DM-602 – Excessive STC

DM-604

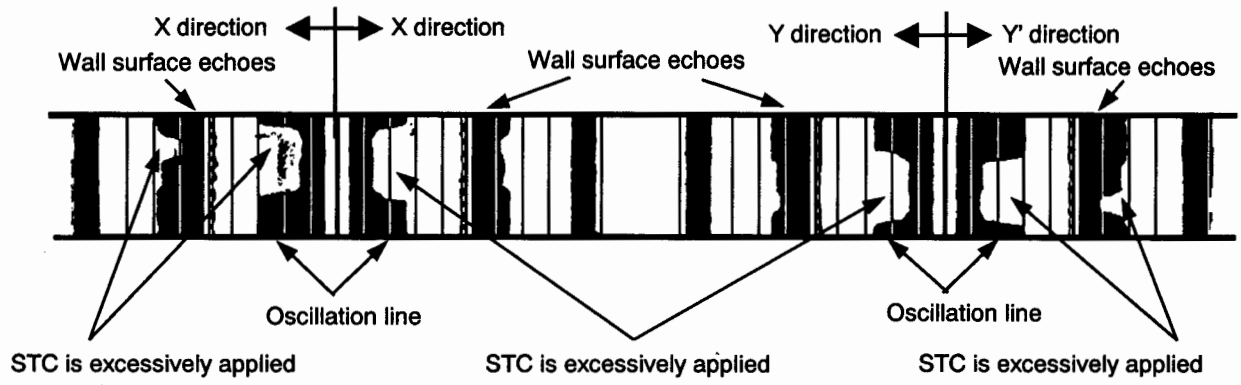


Figure 5.13 Recording example of DM-604 – Excessive STC

5.3.13 Rejecting the oscillation line and image enhancement

For easy observation of the image, the oscillation line and wall surface echoes can be processed by the OS. REJ switch and SIG. PRCS switches. Details are as follows:

OS.REJ switch

ON: The oscillation line is deleted from the image record.

OFF: The oscillation line is displayed on the image record.

This switch should be set to OFF normally.

SIG.PRCS switch

ON: The wall echoes is enhanced on the record.

OFF: The wall echoes are recorded without enhancement.

This switch should be set to OFF normally.

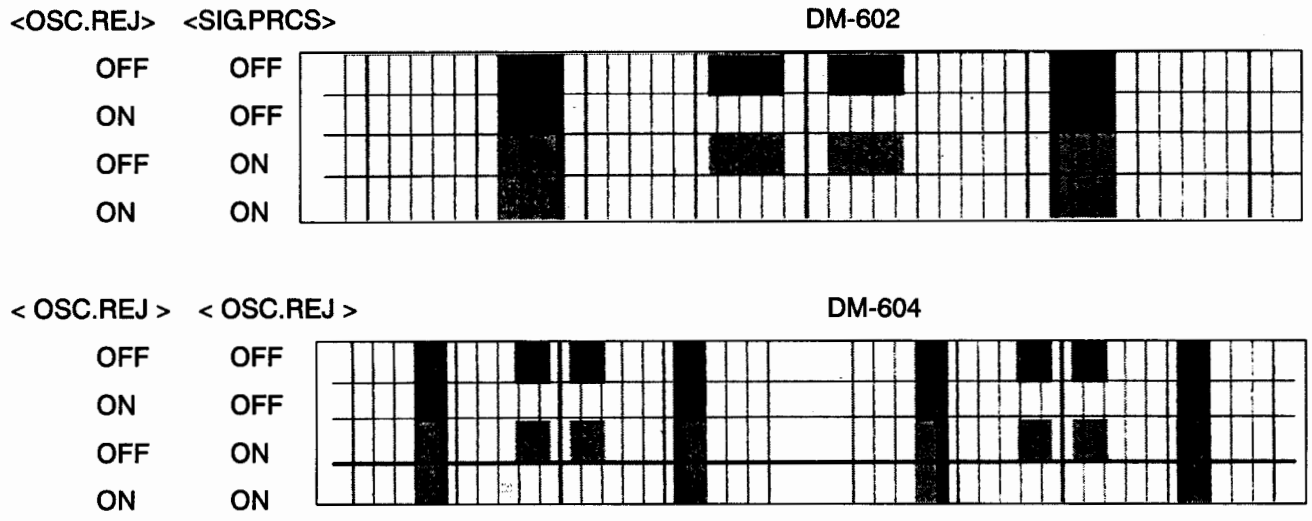


Figure 5.14 Setting up for signal processing

5.3.14 Range calibration

This function is used to align the measured distance with the actual distance between the sensor and the wall surface inside the casing or the guide wall. To do so:

(1) Set the wall face diameter mark with the inside diameter of the casing or the guide wall.

(2) Turn the CALIBRATION dial to align the image of the guide wall or the casing with the wall face diameter mark (dotted line).

NOTE: *The speed of ultrasound depends on the conditions of the Bentnite (temperature, specific gravity, etc). This causes a difference in the measured result compared to the actual diameter of an excavated hole. The action taken to examine this difference is called "bar check".*

Make sure to carry out the bar check before attempting the measurement.

The following figures illustrate a typical example of an image where a bar check is performed. The arrows in the figures show the wall surface image moved by the range calibration dial.

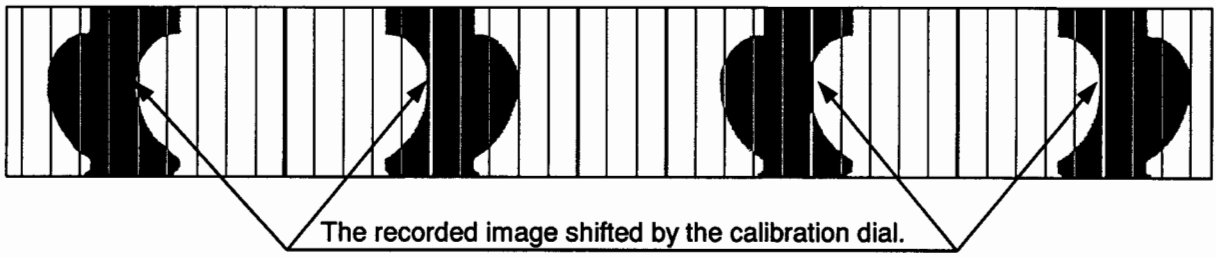


Figure 5.15 An example image record of the range calibration (DM-604)

5.4 Interpreting the recorded image

5.4.1 Examples of the recorded images

Remarks: DM-602, Descent mode measurement

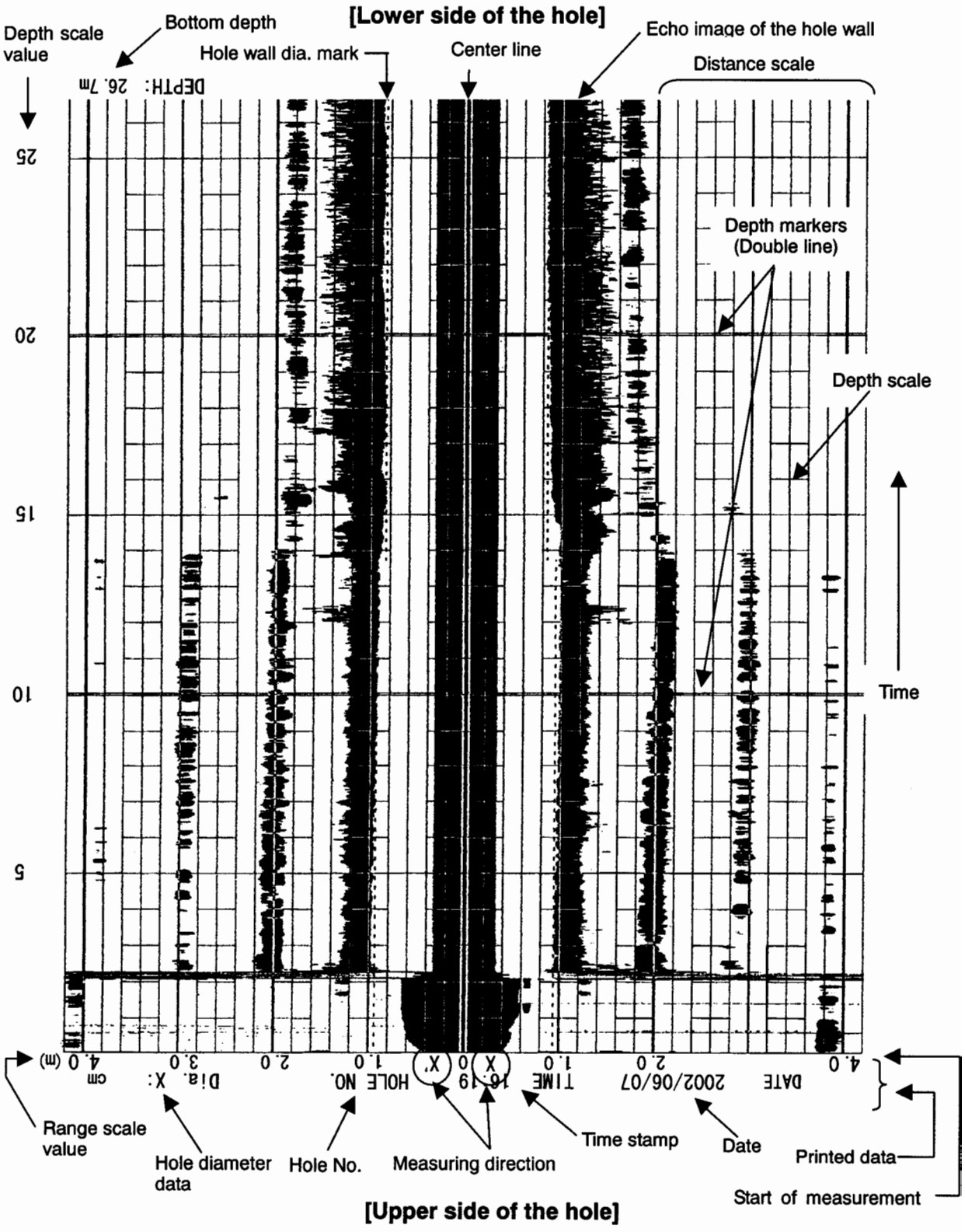


Figure 5.16 An example image record of DM-602 (1)

Remarks: DM-602, Oscillation Line ON, Descent mode measurement

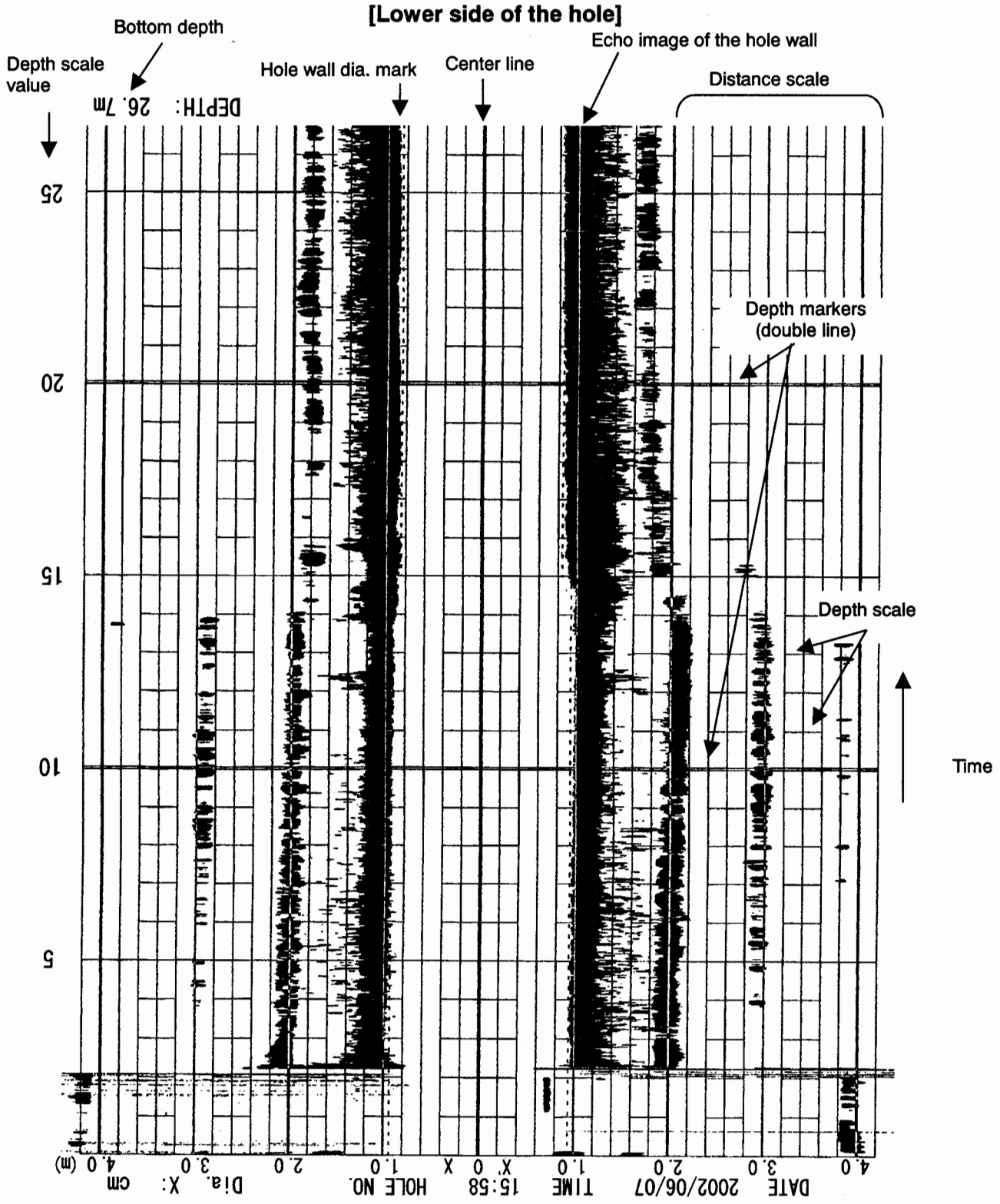


Figure 5.17 An example image record of DM-602 (2)

Remarks: DM-602, Oscillation Line ON, Ascent mode measurement

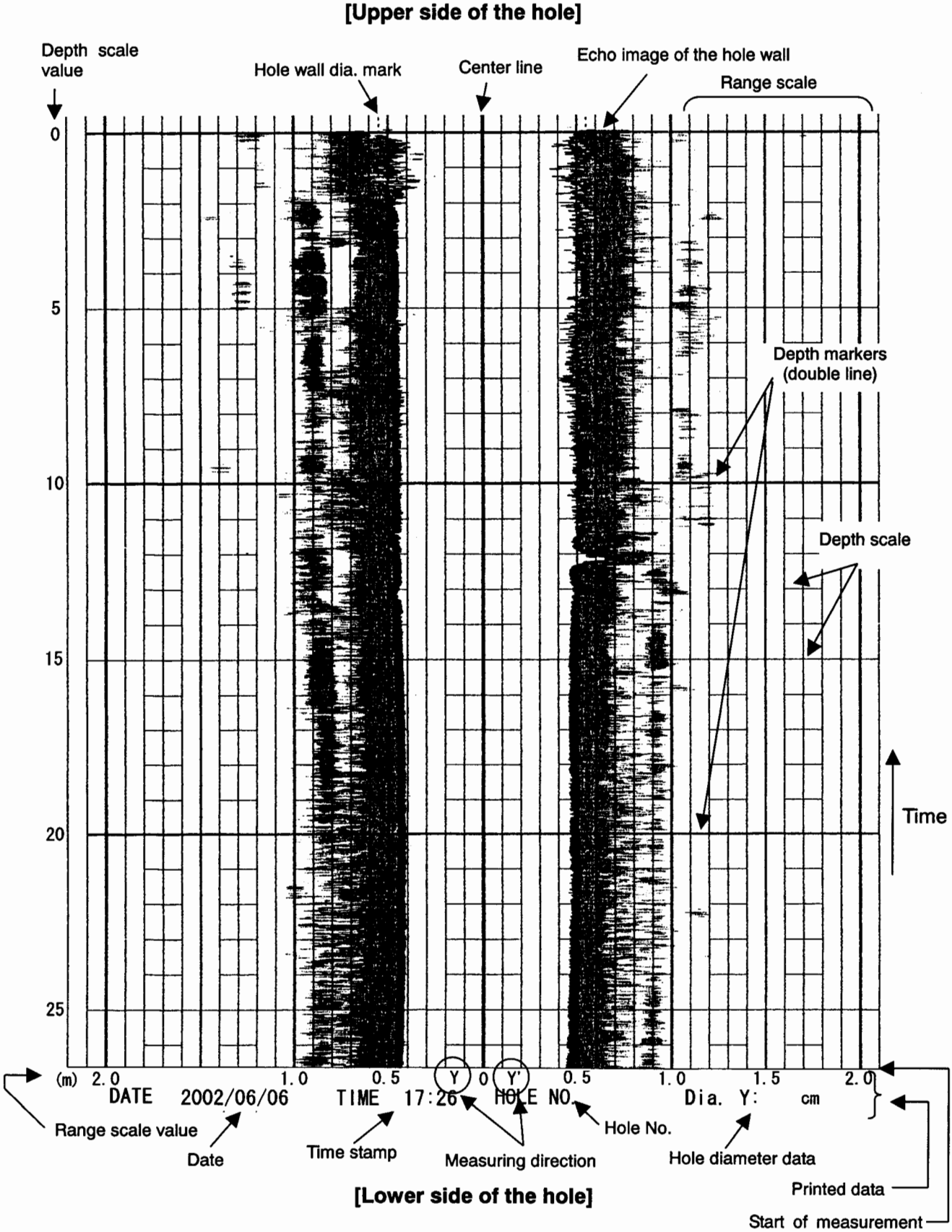


Figure 5.18 An example image record of DM-602 (3)

Remarks: DM-604, Oscillation Line ON, Ascent mode measurement

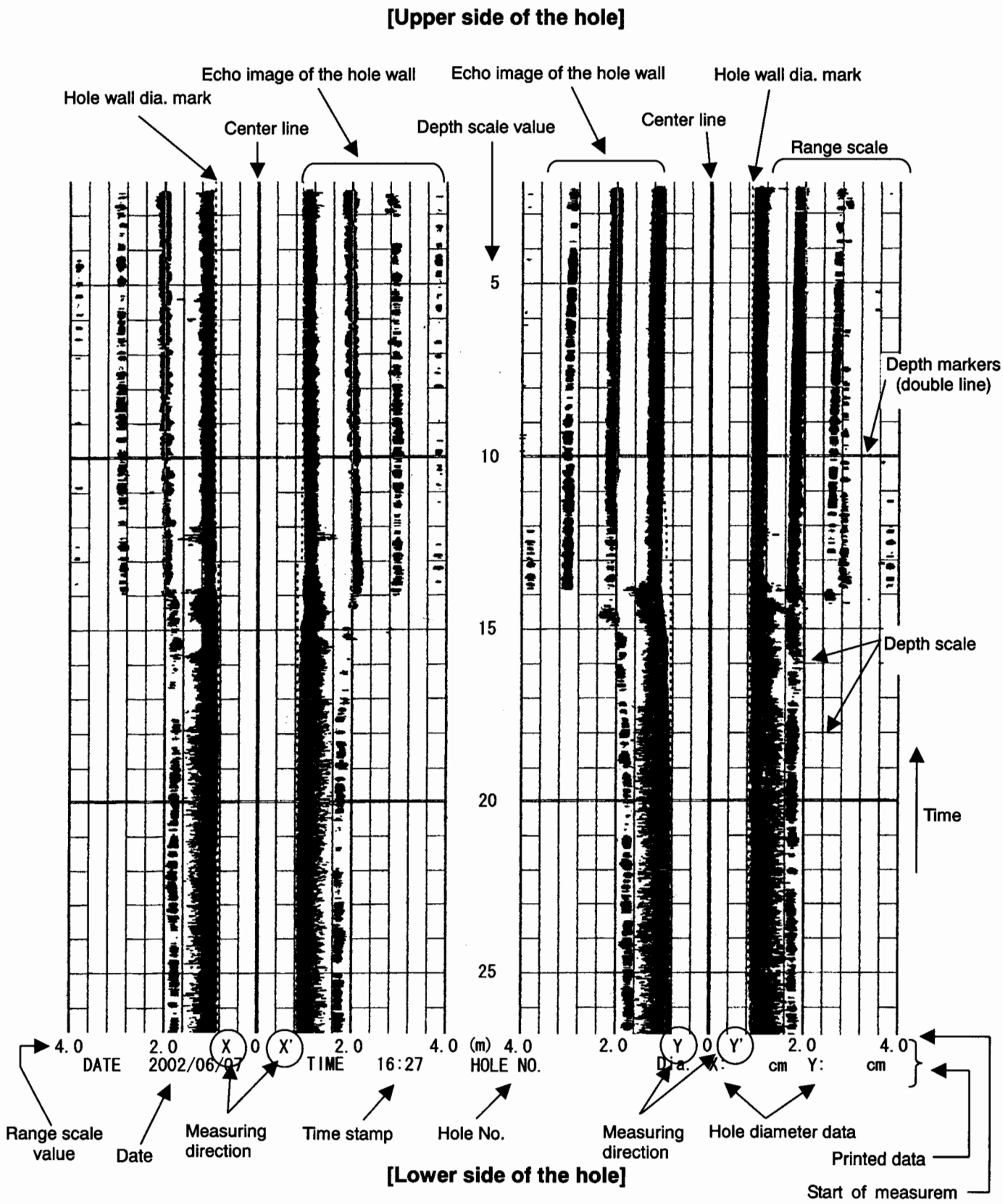


Figure 5.19 An example image record of DM-604 (1)

5.4.2 Preparations for better measurement results

Before attempting a measurement, make sure that the current stylus, recording stylus and recording belt are properly fitted. If not, take corrective actions.

Set the MAN mark switch to ON and confirm that the mark is clearly drawn. If the line is found blurred, replace both the current stylus and recording stylus together. It is recommended to replace the recording paper after 3 recording rolls have been used. For replacement procedure of these styluses, refer to the following paragraph.

⚠ Warning

Replace the recording paper when a red belt appears on the paper. Never run the recorder without the paper, otherwise damaged to the styluses as well as a system fault may occur.

5.5 Replacing the styluses

The current stylus and recording stylus are consumable parts, both used in a movable section in the recorder unit. Due to constant contact with the recording paper (electrical potential), these parts are worn out with time, causing blurred or no recording to happen in. In such a case, replace both styluses with new ones. When starting the measurement with new styluses, gently sandpaper on the needle point beforehand. Follow the replacement procedures below:

(1) Turn the RECORDER POWER switch to OFF.
(2) Raise the belt and then lift the stylus up to disengage from the groove.
(3) Turn the stylus needle to the left and take it out of the guide pin.
(4) Insert a new stylus (coiled body) on to the guide pin with its point directed upward.
(5) Turn the needle to the right and put it into the groove.
(6) Insert #600 grit sandpaper between the recording paper and the recording stylus and then turn the Recorder unit on.
(7) Polish the needle point with the sandpaper and run the Recorder with the manual mark on to see the recording status. Repeat this procedure until a fine and clear line is recorded.

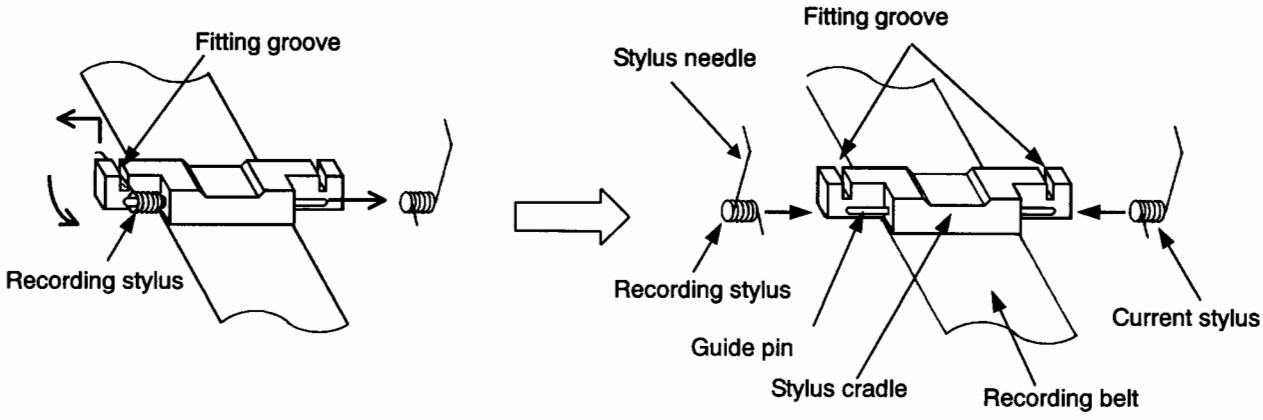


Figure 5.20 Replacing the styluses

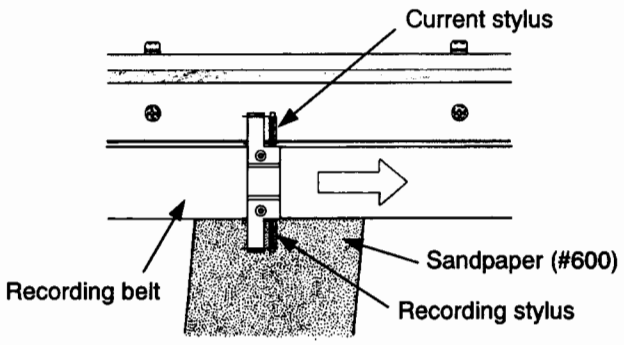


Figure 5.21 Fitting the sandpaper under the recoding belt

5.6 Replacing the recording paper

Warning

Make sure you use KODEN genuine recording paper (Electro-sensitive paper roll type DMP-250 A3-560). Usage of foreign type paper may cause a fault in the operation of the DM. In such a case, KODEN would not assume any responsibility for warranty claim.

(1) Make sure that no sheet of recording paper is left on the recording table. If there is, press the recording belt towards the right until the recording stylus comes underneath the recording table.
(2) Hold the hinges attached on the both sides of recording plate and pull them towards you.
(3) Remove the recording paper spool (reel) attached under the recording table.
(4) Remove the spool end attached on both sides of the paper spool and attach them to the spool of a new paper role.
(5) Pull out a sheet of new recording paper by approximately 40 cm and pass it over the recording table, in between the upper and lower roller and then under the paper cutter.
(6) Rest the hinges on the recording table.
(7) Turn the Manual Paper Feed knob towards an arrow printed on the operation panel to take up the paper.

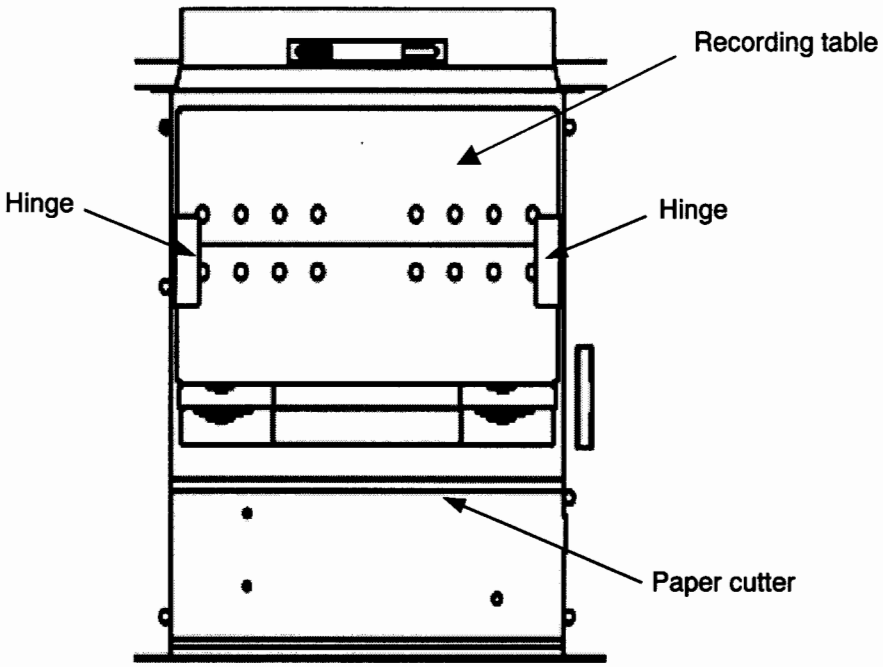


Figure 5.22 Recorder unit in normal position

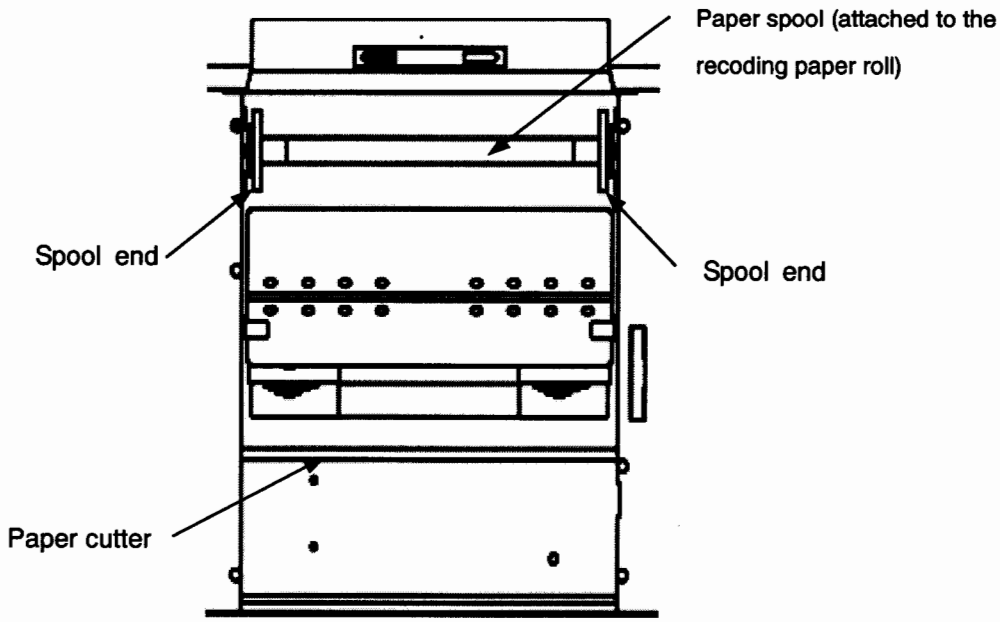


Figure 5.23 Recorder unit in service position

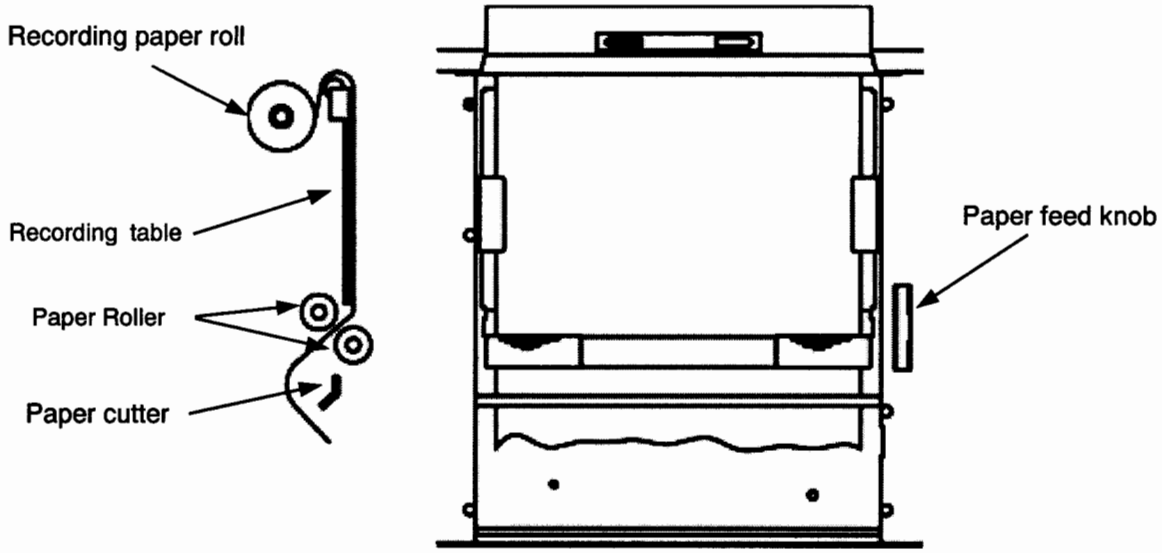


Figure 5.24 Setting the recording paper roll (2)

Chapter 6

Using the Menu

Contents

Chapter 6 Using the Menu

This chapter describes the necessary procedures to set up the menu driven functions. Once the menu items are set, these data remain in the memory even if the systems are re-powered.

6.1 Starting menu functions

6.1.1 Displaying the menu display

A press of the MENU/DIGIT SHIFT switch to the right changes the sensor speed/depth display to the menu display. The Table 6.1 shows the list of the menu items available in this function.

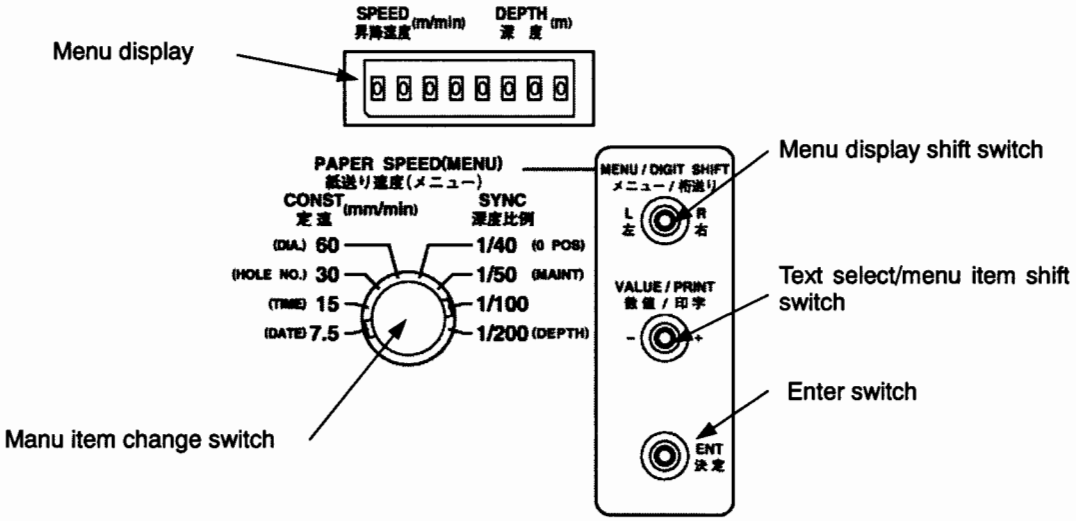


Figure 6.1 Switches and display for the menu functions

Table 6.1 Menu items

Menu display	Items	Actions to be set
(DATE) 7.5	Date	Date correction and print YES/NO
(TIME) 15	Time	Time correction and print YES/NO
(HOLE NO.)30	Hole No.	Setting the hole number and print YES/NO
(DIA.) 60	Hole diameter	Setting the hole diameter value and print YES/NO
(0 POS) 1/40	"Distance 0" position correction	Entering corrected "Distance 0" value
(MAINT) 1/50	For maintenance	Maintenance personnel use only
(DEPTH) 1/200	Depth display	

6.2 Printing the date and time

DM-602/604 has the function to print the date and time for later review when a measurement is conducted.

6.2.1 Confirming/setting the measurement date display

(1) Turn the PAPER SPEED (MENU) switch to select DATE while the recorder unit is stopped.

(2) Press the MENU/DIGIT SHIFT switch to the right to show the time display.
If you need to change the date, further press the MENU/DIGIT SHIFT switch to the right. The further left digit will start to flash.

(3) Press the MENU/DIGIT SHIFT switch to the left or the right to select a digit to be modified.

(4) Press the VALUE/PRINT switch to "-" or "+" to select a desired value.

(5) Repeat step 5 and 6 for other digit settings, if required.

(6) Confirm that the digit settings are correct and then press the ENT key to ENT. The flashing display accordingly stops and the time display is now set.

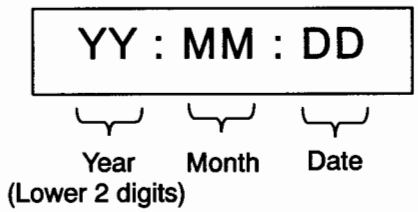


Figure 6.2 The date display

6.2.2 Confirming/setting the measurement time display

(1) Turn the PAPER SPEED (MENU) switch to select TIME while the recorder unit is stopped.

(2) Press the MENU/DIGIT SHIFT switch to the right to show the date display.
If you need to change the date, further press the MENU/DIGIT SHIFT switch to the right. The further left digit will start to flash.

(3) Press the MENU/DIGIT SHIFT switch to the left or the right to select a digit to be modified.

(4) Press the VALUE/PRINT switch to "-" or "+" to select a desired value.

(5) Repeat step 5 and 6 for other digit settings, if required.

(6) Confirm that the digit settings are correct and press the ENT key to ENT. The flashing display accordingly stops and the date display is now set.

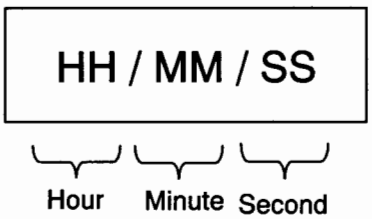
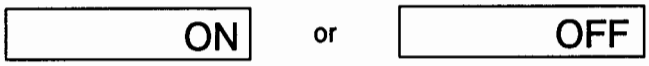


Figure 6.3 The time display

6.2.3 Confirming/setting the measurement date to be printed or not

This procedure sets up the date of a measurement to be printed or not on the recorded paper. To do so, perform the following procedure:

(1) Turn the PAPER SPEED (MENU) switch to select DATE while the recorder unit is stopped.
(2) Press the MENU/DIGIT SHIFT switch to the right to show the date display ON or OFF.
(3) If you need to change the setting, press the VALUE/PRINT switch to "-" or "+" to select ON or OFF, which is flashing.
(4) Every press of the switch to "-" or "+" will alter the display to ON or OFF.
(5) Press the ENT key to fix the selection. The flashing will stop accordingly.



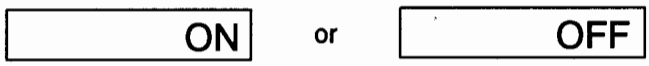
ON : Date data to be printed
OFF: Date data not to be printed

Figure 6.4 Menu display for date data print ON/OFF

6.2.4 Confirming/setting the measurement time to be printed

This procedure sets up the time of a measurement to be printed or not on the recorded paper. To do so, perform the following procedure:

(1) Turn the PAPER SPEED (MENU) switch to select TIME while the recorder unit is stopped.
(2) Press the MENU/DIGIT SHIFT switch to the right to show the time display ON or OFF.
(3) If you need to change the setting, press the VALUE/PRINT switch to "-" or "+" to select ON or OFF, which is flashing.
(4) Every press of the switch to "-" or "+" will alter the display to ON or OFF.
(5) Press the ENT key to fix the selection. The flashing will stop accordingly.



ON : Time data to be printed
OFF: Time data not to be printed

Figure 6.5 Menu display for time data print ON/OFF

6.3 Printing the hole number

The number of an excavated hole can be printed on the recording paper in 6 digits numerals. Refer to the following paragraphs for detail.

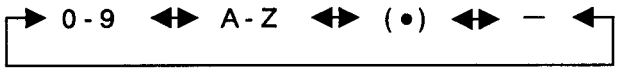
6.3.1 Confirming/setting the hall number display

(1) Turn the PAPER SPEED (MENU) switch to select HOLE NO. while the recorder unit is stopped.
(2) Press the MENU/DIGIT SHIFT switch to the right to show the hole number display.
(3) If you need to change the setting, press the MENU/DIGIT switch to the right. The digit on the right

of "No" will start to flash.

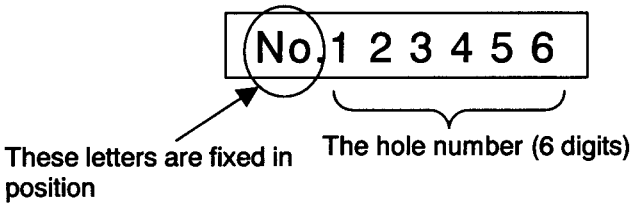
(4) Press the MENU/DIGIT switch to the left or the right to select a digit to be modified. Available numbers and texts are as follows: 0 – 9, A – Z, (–) and (•).

(5) Press the VALUE/PRINT switch to (+) or (-) to select a number or text. Available numbers and texts are: 0 – 9, A – Z, ( ) and ( ). The selecting sequence is as follows:



(6) Repeat step 4 and 5 for other digit settings, if required.

(7) Confirm the entries and press the ENT key to fix. Flashing will stop accordingly. The following is an example of an entry.



6.3.2 Confirming/setting the hole number printing ON/OFF

This procedure sets up the hole number to be printed or not on the recorded paper. To do so, perform the following procedure:

(1) Turn the PAPER SPEED (MENU) switch to select HOLE NO. while the recorder unit is stopped.

(2) Press the MENU/DIGIT SHIFT switch to the right to show the hole number display ON or OFF.

(3) If you need to change the setting, press the VALUE/PRINT switch to "-" or "+" to select ON or OFF, which is flashing.

ON : Hole number to be printed
OFF: Hole number not to be printed

(4) Every press of the switch to "-" or "+" will alter the display to ON or OFF.

(5) Press the ENT key to fix the selection. The flashing will stop accordingly.

6.4 Printing the hole diameter

The hole diameter is the diameter of an excavated hole that is to be printed as measurement data which is different to the hole wall diameter mark width. If you wish to print the hole wall diameter mark width as the diameter of a hole, set the hole diameter values to "0". The factory default value is "0".

6.4.1 Confirming/setting the hole diameter

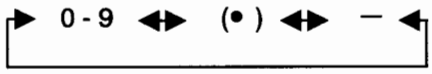
1 Turn the PAPER SPEED (MENU) switch to select DIA while the recorder unit is stopped.

2 Press the MENU/DIGIT SHIFT switch to the right to show the hole number display. The diameter of the designated hole will be displayed.

3 If you need to change the setting, press the MENU/DIGIT switch to the right. The digit on the right of "X" will start to flash.

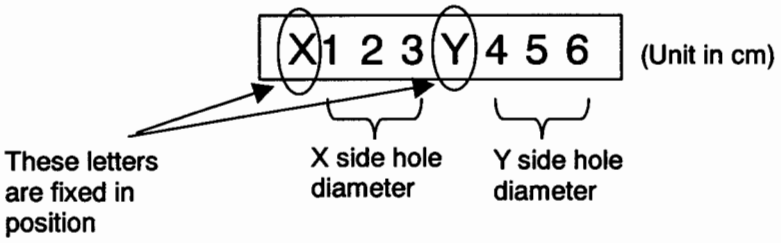
4 Press the MENU/DIGIT switch to the left or the right to select a digit to be modified.

5 Press the VALUE/PRINT switch to (+) or (-) to select a number or text. Available numbers and texts are: 0 – 9, A – Z, (•) and (—). The selecting sequence is as follows:



6 Repeat step 4 and 5 for other digit settings, if required.

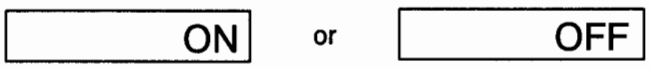
7 Confirm the entries and press the ENT key to fix. Flashing will stop accordingly. The following is an example of an entry.



6.4.2 Confirming/setting the hole diameter to be printed

This procedure sets up whether the hole diameter data to be printed or not on the recorded paper. To do so, perform the following procedure:

1. Turn the PAPER SPEED (MENU) switch to select DIA while the recorder unit is stopped.
2. Press the MENU/DIGIT SHIFT switch to the right to show the hole diameter display ON or OFF. If you need to change the setting, press the VALUE/PRINT switch to "-" or "+" to select ON or OFF, which is flashing.
3. Every press of the switch to "-" or "+" will alter the display to ON or OFF. To print, select ON and not to print select OFF.
4. Press the ENT key to fix the selection. The flashing will stop accordingly.



ON : Hole diameter to be printed
OFF: Hole diameter not to be printed

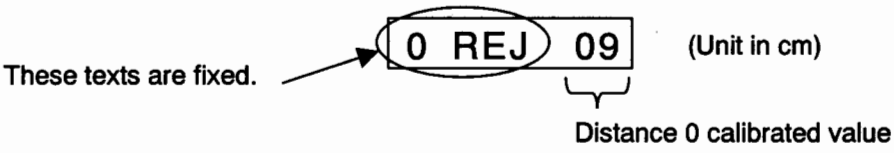
Figure 6.4 Menu display for hole diameter print ON/OFF

6.5 Correcting the Distance 0

This procedure is used to calibrate the reference point of the distance, taking the physical dimensions of the sensor unit into account. When shipped, this amount is set to 09 as the sensor unit dimensions are 9 cm x 9 cm. Do not change this value as far as the system is equipped with standard sensor unit, otherwise the measurement result will be deviated.

6.5.1 Confirming/setting the Distance 0

1. Turn the PAPER SPEED (MENU) switch to select 0 POS while the recorder unit is stopped.
2. Press the MENU/DIGIT SHIFT switch to the right to show the Distance 0 display. If you need to change the setting, press the MENU/DIGIT switch to the right. The seventh digit from the right starts to flash.
3. Press the MENU/DIGIT SHIFT switch to the left or the right to select a digit to be modified.
4. Press the VALUE/PRINT switch to the left or the right to set the value
5. Repeat this procedure for another digit, if required.
6. Press the ENT key to fix the values. The flashing will stop accordingly.



6.6 Maintenance menu

Only service personnel should use this function. User operation is not permitted.

6.7 Resetting the display to normal measurement display

There are the following two ways to resume the normal display for the sensor speed (m/min) and depth(m).

1. Select by the PAPER SPEED (MENU) switch the SYNC 1/200 (DEPTH) speed
2. Start recording.

Chapter 7

Maintenance

Contents

Chapter 7 Maintenance

7.1 Maintenance after measurement

7.1.1 Winch unit

(1) Remove mud, slurry, etc. left on the surface of the cable drum, wire drum, cable retaining rollers, etc unit using a high-pressure water gun. Before doing so, make sure that the connector is covered with a protection cap. Never squirt water directly into each section of the motor, slip ring, and rotary encoder. At the time of cleaning by a high-pressure water gun,please clean these from topward to the bottomward. Don't do from the bottom for the equipment protection to the top.

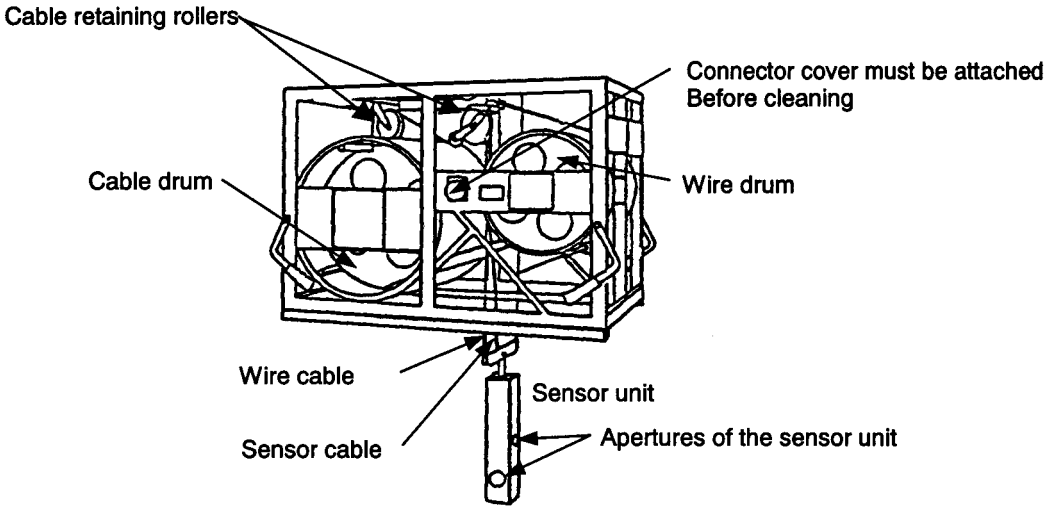


Figure 7.1 Cleaning points

(2) After cleaning, apply grease to the rotating sections in the wire retainer rollers and the wire support chassis. Also apply mechanical oil to the driving chain. Refer to Figure 7.2 and Figure 7.3.

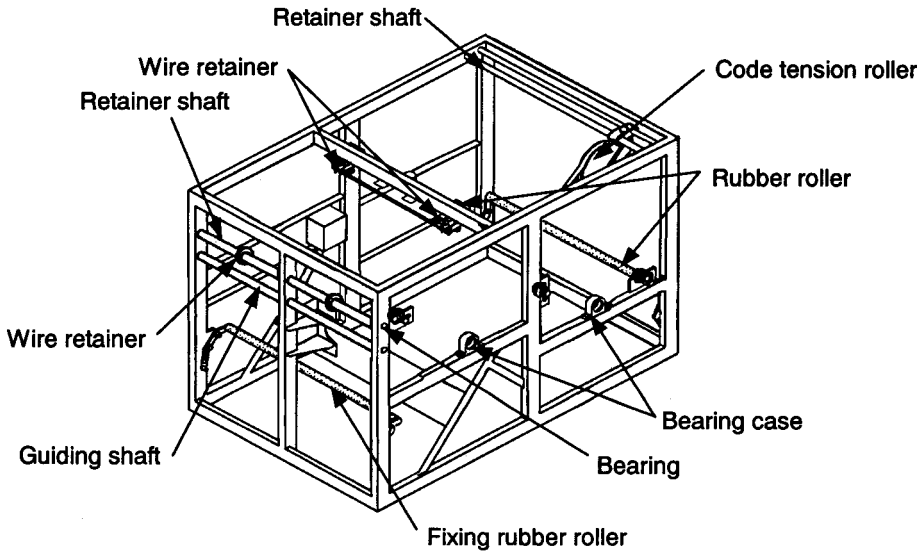


Figure 7.2 Greasing points in the Winch unit (1)

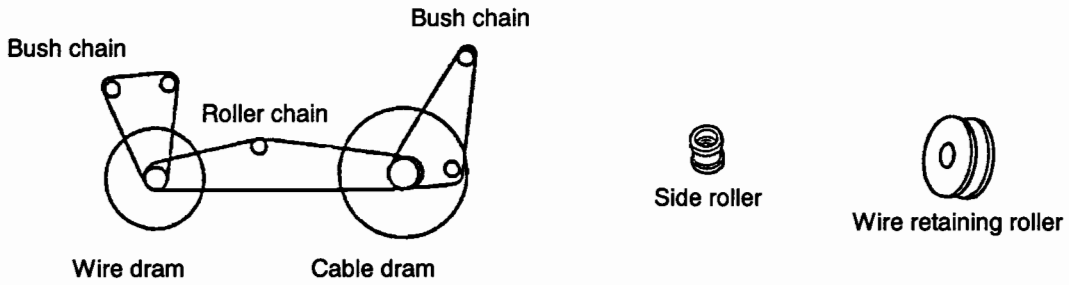


Figure 7.3 Greasing points in the Winch unit (2)

(3) Wipe off the excess water on the cable and store it in the parts compartment in the Recorder unit. Do not forget to fit the protection cover on the plug socket.

(4) Put the cover on the Winch unit and store it on a flat surface in a place of low humidity. Avoid irregular surface for storage that may result in the deformation of the drum weight being imbalanced.

7.1.2 Recorder unit

(1) Wipe off the surface of the recording unit as well as the recording section to remove dust and mud using a soft cloth, lightly soaked with fresh water.

(2) The recording stylus and the current stylus should be checked periodically for good recording. To do so, press the MAN MARK switch to ON to print the test pattern. If the pattern is not clear or blurred, replace both styluses. Recommended replacement interval is every 3 rolls of recording paper. For replacement detail, refer to Para 5.18 "Replacing styluses".

(3) If a red sign appears on the recording belt, replace the roll of recording paper with a new one.

Warning

Recording without the paper may result in serious damage to the recorder unit.

7.1.3 Routine inspection by the user

The following table shows a routine check ups to keep the unit in good order. If any fault is found, Please contact your nearest KODEN dealer for repair.

Recorder unit

No.	Check points
1	Any damage to the surface of aluminum case?
2	Any damage to the power cable and connector?
3	Any damage to the connecting cable?
4	Any worn out to the recording stylus?
5	Any worn out to the current stylus?

No.	Check points
6	Any contamination on the feeding rail?
7	Is there slack on the recording belt
8	Is the main supply voltage range normal? (The meter should read a voltage from 90 – 110 VAC)
9	Check record in Test mode. (Simulated signal)
10	Do Operational checks in measuring mode.
10-1	Are the echoes from a reflection plate recorded in X-X' direction?
10-2	Are the echoes from a reflection plate recorded in Y-Y' direction?
10-3	Does the CALIBRATION dial function normally?
10-4	Is the MAN (Manual) MARK recorded?
10-5	Is the hole wall diameter mark recorded?
10-6	Does the hole wall diameter mark move?
10-7	Does the winch drive motor stop when the sensor unit reaches the bottom of the hole or the casing?
10-8	Does the recording paper advance normally at CONST (Constant) speed?
10-9	Does the recording paper advance normally at SYNC (Synchro) speed?
10-10	Does the roll paper remain adequately? No red sign appears on the paper?
10-11	Are the switches in the sub panel normal in operation?
10-12	Are the spare recording paper rolls provided?
10-13	Are the spare recording and current styluses provided?
10-14	Is the operation manual provided?

Winch unit

	Check points
1	Is there any deformed frame?
2	Are the connector pins clean without corrosion?
3	Is the connector cover fitted?
4	Is there any damage on the sensor cable
5	Is there any entanglement on the sensor cable?
6	Is the sensor cable properly wired without slack?
7	Is there any damage on the wire rope
8	Is there any entanglement on the wire rope?
9	Is the wire rope well balanced?
10	Does the wire rope joint rotate?
11	Is there any worn out on the wire side roller?
12	Is there any worn out on the wire retainer roller?

Chapter 8

Trouble shooting and repair

Contents

Chapter 8 Trouble shooting and repair

8.1 Information required for service

Before requesting service, please inform the following information at least.

(1) Sales agent name, telephone number, fax number, e-mail address, etc.

(2) Faulty conditions in detail, where possible.

Table 8.1 Trouble shooting list

Symptoms of failure	Possible cause of failure	Countermeasures
Both the Recorder unit and Winch unit are not operable	Power cable problem	Check the power meter if 100 VAC supply is correct.
	The leakage breaker has tripped.	Check the cause of the failure and fix and then reset the breaker.
	Recorder unit and winch breaker are tripped. (The Reset button is extruded)	Check the cause of the failure and fix it. Allow 1 minute or more and then push in the button.
	The power meter indication is more than 110 VAC.	Lower the AC mains down to 100 VAC and then re-power the system.
Recording belt does not rotate	Recorder power switch is faulty.	Contact your local KODEN service agent.
	Power PCB is faulty.	Contact your local KODEN service agent.
Paper does not advance	Power PCB is faulty.	Contact your local KODEN service agent.
	Paper drive motor is faulty.	Contact your local KODEN service agent.
	Paper drive mechanism is faulty, paper jamming, etc.	Remove jammed paper, foreign object, etc. from the paper drive mechanism.
	Connecting cable between Recorder Unit and Winch unit is faulty.	Check cable connection. Replace the connecting cable.
Various marks are printed but no hole wall echoes are recorded.	Connecting cable between Recorder Unit and Winch unit is faulty.	1. Check cable connection. 2. Replace the connecting cable.
	Settings are incorrect.	Reset the range, shift, gain and STC.
	Poor sensitivity	1. Confirm the sensitivity referring to Para. 8.3.2.2 "Sensitivity check in the air". 2. If the failure still persists, contact your local KODEN sales agent.
	Oscillation line rejection is activated.	In the case of short distance measurement the Oscillation Line Rejection function may reduce the sensitivity of the nearby echoes. In such a case, try to turn off this function.

Symptoms of failure	Possible cause of failure	Countermeasures
(Various marks are printed but no hole wall echoes are recorded.)	TX/RX PCB is faulty.	Contact your local KODEN sales agent.
No marks and no echoes are shown	Recording stylus or current stylus is faulty	Replace the recording stylus and current stylus
	Recording belt is faulty	Check if the timing magnet is fitted or not. If NO, replace the recording belt.
	Power PCB or Control PCB is faulty.	Contact your local KODEN sales agent.
Wall hole diameter mark is not printed	Relevant settings are not correct	Reset the range and shift.
	Control PCB is faulty.	Contact your local KODEN sales agent.
Depth mark is not printed.	Depth Mark switch is set to OFF.	Set the Depth Mark switch to ON.
	Connecting cable between Recorder Unit and Winch unit is faulty.	1. Check cable connection. 2. Replace the connecting cable.
	Control PCB is faulty.	Contact your local KODEN sales agent.
No depth indication	Control PCB is faulty.	Contact your local KODEN sales agent.
Winch unit is not operable	Winch breaker is faulty. (The reset button is extruded.	Check the cause of failure and fix it. Allow 1 minute or more and then push in the button.
	Connecting cable between Recorder Unit and Winch unit is faulty.	1. Check cable connection. 2. Replace the connecting cable.
	Winch control switch is set to STOP.	Set the Winch control switch to UP or DOWN and check the winch movement.
	Limit switch is operated.	Set the Winch control switch to UP or DOWN and check the winch movement.
	The winch speed control switch (SPEED) is set to fully left position.	Turn the winch speed control to the right and check the winch movement.
	Motor control PCB is faulty.	Contact your local KODEN sales agent.
	Motor is faulty.	Contact your local KODEN sales agent.

8.2 Possible causes of faulty records

In case proper images are not available even if the recorder and winch unit functions are in good order, use the following diagnosis.

8.2.1 Recorded images are all black

Possible cause: The specific gravity of bentnite is too high.

If the bentnite contains a large amount of sands and dirt, the specific gravity will increase to the value higher than 1.2. In such a condition, the ultrasound wave may be diffused, causing multi reflections within the hole. In this case, no clear image of the wall surface will be available even if the gain control or STC control is introduced. To solve this problem, replace the bentnite with a

new bentnite to reduce the specific gravity of the fixing solution.

8.2.2 No image record available

Possible cause: Air bubbles in bentnite

Air bubbles may remain in a hole immediately after excavation work. This may interrupt the propagation of ultrasound, causing no image to be shown. Even minute bubbles could interrupt the ultrasound propagation. Further, air bubbles contained in the bentnite with high specific gravity and high viscosity remain for a long time. Again, an effective solution is to keep the specific gravity of the fixing solution less than 1.2 of the specific gravity

8.2.2.1 Poor echo images

Possible cause: Bentnite with high specific gravity is being used and the distance to the wall is relatively far, say, 3m or more.

The maximum measuring distance with DM-602/604 is 4 meters, and 8 meters when the range shift function is used. This capability may be worsened when high specific gravity bentnite is used.

8.2.2.2 Sensitivity check in the air

In case the wall image record is poor even if all possible checks on the bentnite or polymer solution are normal, use the following method to determine the drilling monitor's detection capability.

(1) Put the sensor unit stationary in the position as indicated in the following figure.

(2) Set the switches and controls on the operation panel as follows:

1. RANGE switch: 4m
2. Range CALIBRATION dial: 8
3. SHIFT switch: 0%
4. GAIN control: To fully right position
5. STC ADJ control: To fully left position
6. PAPER SPEED switch: CONST 60 (mm/min)

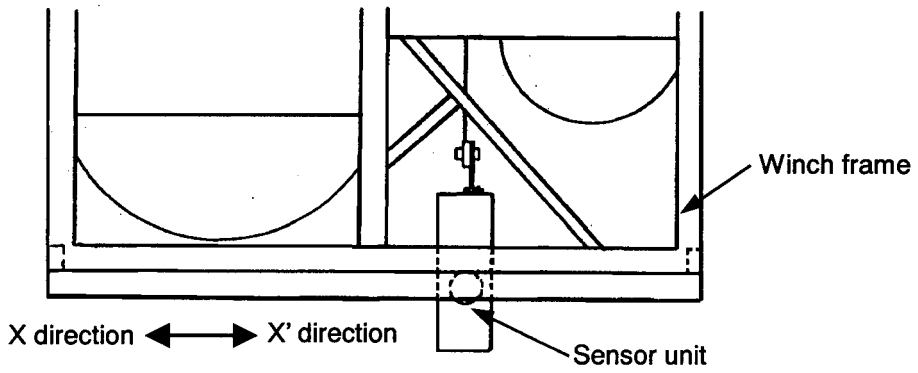


Figure 8.1 Position of the sensor unt

(3) Operate the Drilling Monitor to confirm the image of the Winch unit frame is clearly recorded as shown in the folloing figures.

DM-602

The test image record in X-X' direction (DIR.CHANGE switch to X) and the depth range at 4 m.

Set up good: The first echo is observed

[X-X' direction]

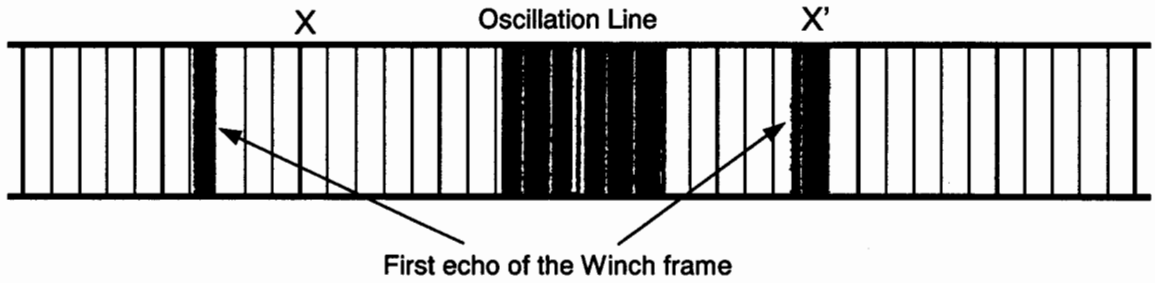


Figure 8.2 Test image echo (X-X') for DM-602

The test image record in Y-Y' direction (DIR.CHANGE switch to Y) and the depth range at 4 m.

Set up good: The second echo is observed

[Y-Y' direction]

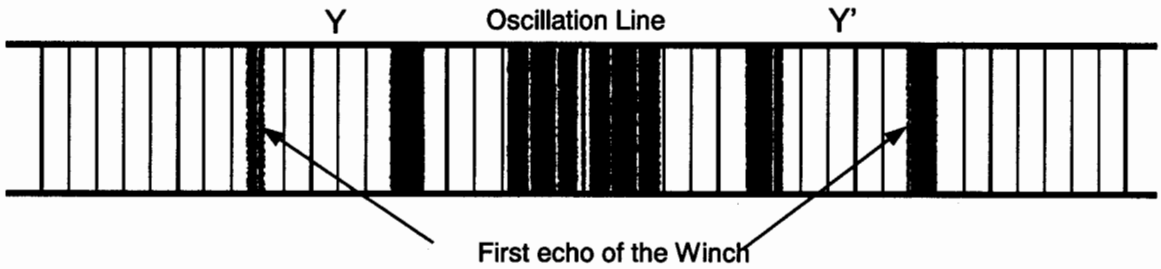


Figure 8.3 Test image echo (Y-Y') for DM-602

DM-604

The test image record in X-X' direction (DIR.CHANGE switch to X) and the depth range at 4 m.

Set up good: The first echo in X-X' and the second echo in Y-Y' directions is observed

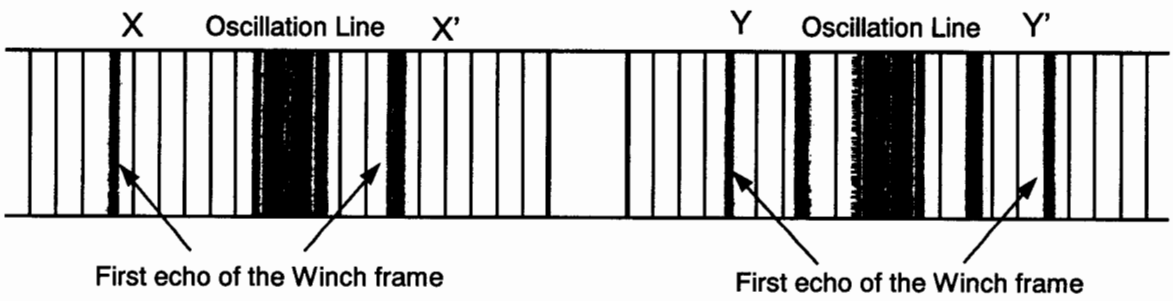


Figure 8.4 Test image echo (X-X') for DM-604

(4) In case a test image is not clearly shown, use two metal plates (40 cm x 40) cm as test objects and placed them parallel to the sensor unit at the specified distances and carry out the same test as previously mentioned in this paragraph.

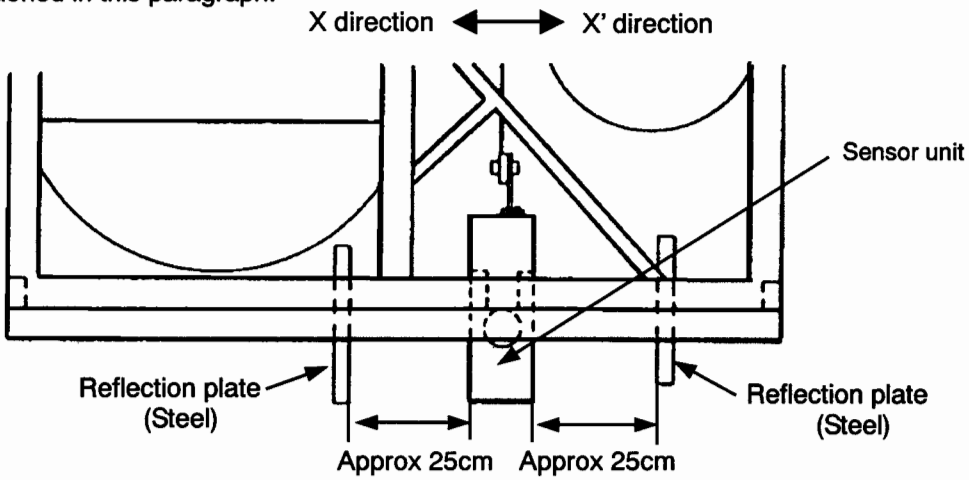


Figure 8.5 Reflection plate positions

(5) The measured distance in the air may be different from what obtained in the solution due to the difference of the propagation speed. If the test results are found normal and yet the actual echo images are poor, the bentnite or polymer solution may be overly contaminated. Replace the solution and redo the measurement after allowing enough time for the air bubbles to disperse.

8.3 Testing the Recorder unit

The test function is provided in the Recorder unit. Use the following procedure to perform the test.

(1) Open the switch cover on top of the recorder panel and find the MODE switch.
(2) Set the switch to TEST. A test image pattern will be recorded.
(3) Change the measurement range using the RANGE switch. The SHIFT switch should be set to 0%.
(4) When the test is completed, reset the MODE switch to MEAS.

DM-602

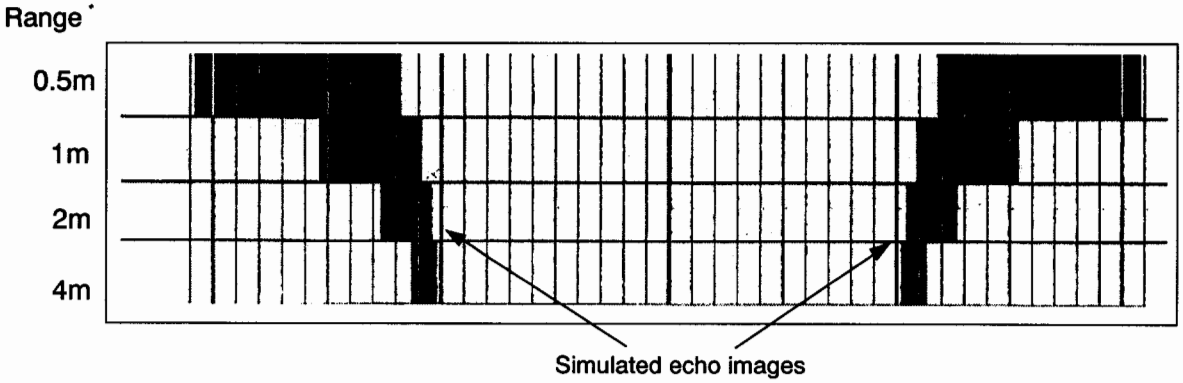


Figure 8.6 Simulated echo images (DM-602)

DM-604

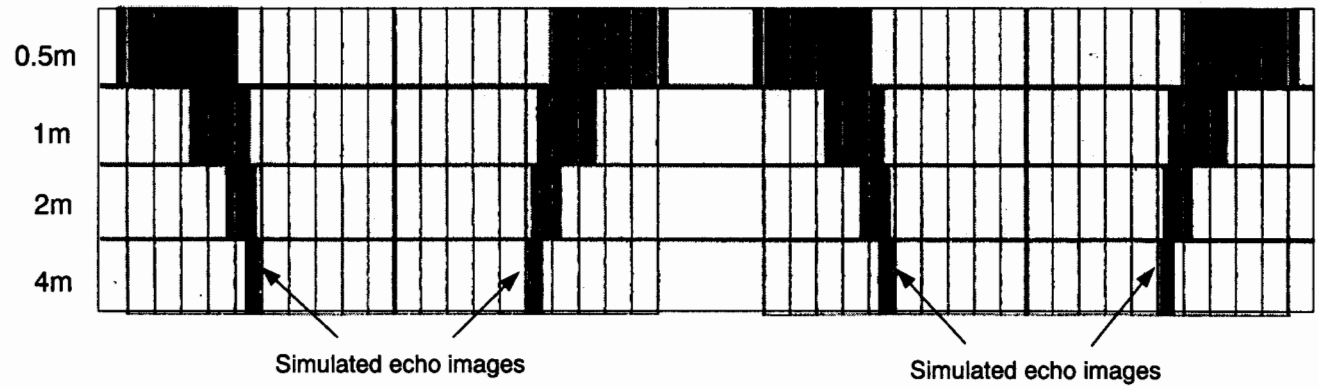


Figure 8.7 Simulated echo images (DM-604)

Chapter 9

Technical Reference

Contents

9.1 Details of the serial data output

(1) Signal level: RS 232C

(2) Signal synchronization method: Start-stop system

(3) Baud rate: 9600 bps

(4) Character format:

Data bit: 8 bit

Stop bit: 1 bit

Parity bit: none

9.2 Output data

9.2.1 Hole data format

DM, XXXXX, XXX, XXX<CR><LF> Total 18 chracters

(1) Header: 2 characters (DM)

(2) Hole data:

Hole Number: 5 digits (0-9, A-E, other symbols, space)

Hole wall diameter X: 3 digits (0-9, space), Unit in cm

Hole wall diameter Y: 3 digits (0-9, space), Unit in cm

Limiter: 2 characters (CR, LF)

9.2.2 Measurement data format

DT, XXXXX, XXXX, XXXX, XXXX, XXXX <CR><LF> Total 30 characters

(1) Header: 2 characters (DT)

(2) Depth: 5 digits (0-9, space), Unit in cm

Measurement data (Recording method, 4 channel to be output irrelevant to the selected measuring mode)

X side wall face distance: 4 digits (0-9, space), Unit in mm

X' side wall face distance: 4 digits (0-9, space), Unit in mm

Y side wall face distance: 4 digits (0-9, space), Unit in mm

Y' side wall face distance: 4 digits (0-9, space), Unit in mm

Limiter: 2 characters (CR, LF)

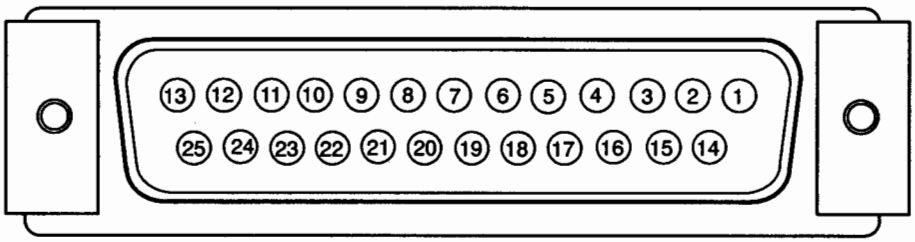
9.2.3 Output connector used

Configuration: D-Sub 25 pins (See Figure 9.1 for pin assignments)

Output signals:

Table 9.1 Pinouts vs Output signals

Pin No.	Signal code (EIA)	Signal name
2	TxD (BA)	Transmission data
3	RxD (BB)	Reception data
6	DSR (CC)	Data set ready
7	GND (AB)	Ground
20	DTR (CD)	Data terminal ready



(Seen from top)

Figure 9.1 D-sub connector pin assignments

9.3 Saving the DM data to PC

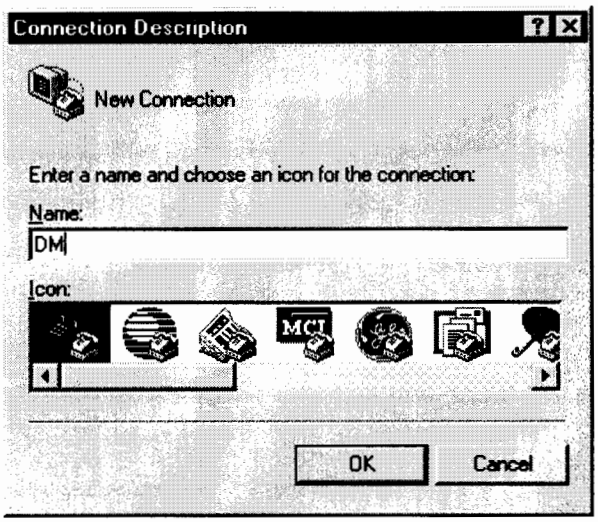
This instruction describes the procedure for saving the excavation data sent from the Drilling Monitor DM-602/604 to a commercially available PC. Required OS is Windows 95, 98, 2000, etc.

9.3.1 Connections

Refer to Figure 9.2 to Figure 9.4 for detail.

9.3.2 Setting up procedures

1. Activate the Hyper Terminal application software by the following menu sequence:
   (1) Go: START => PROGRAM => ACCESSORY => COMMUNICATION => HYPER TERMINAL.
   (2) Double-click the "Hyper trm.exe" icon to activate Hyper Terminal application software. The following window will appear, accordingly.



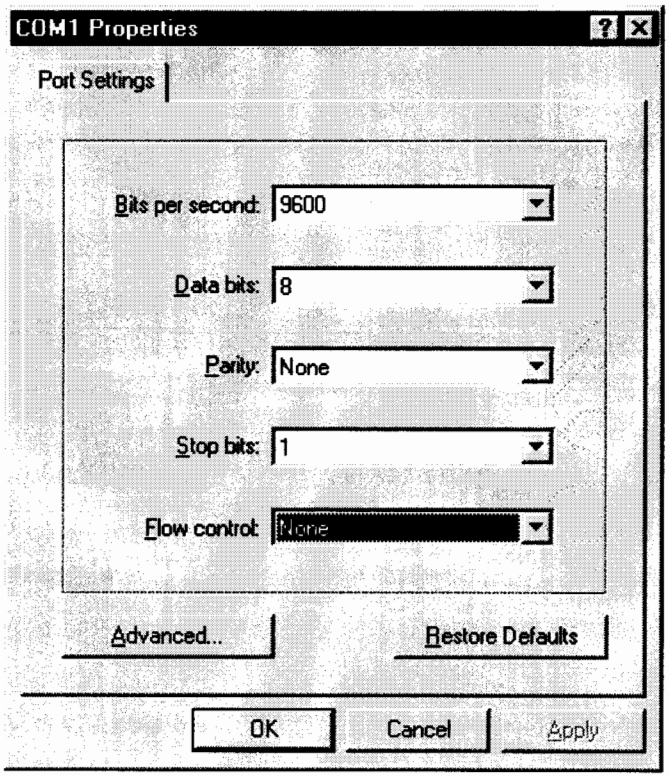
NOTE: *Unless otherwise specified, the term "click" used in this instruction means "left-click."*

2. Enter your preferred name in the Name window ("DM" for example).
3. Click the left or right arrow to choose your preferred icon. (The leftmost icon is recommended)
4. Click OK. The "Connect To" window will appear next.

NOTE: *From the second operation, you can skip the following step 5 through to step 7. Simply click the icon chosen in step 3.*

5. Click the down arrow attached to the "Connect using" window and choose "Direct to Com1" and press OK. (Other data windows such as Country code, Area code, etc, are not used)

6. Select a specific parameter to each item as shown in the "COM 1 Properties" window by clicking a down arrow and press OK.

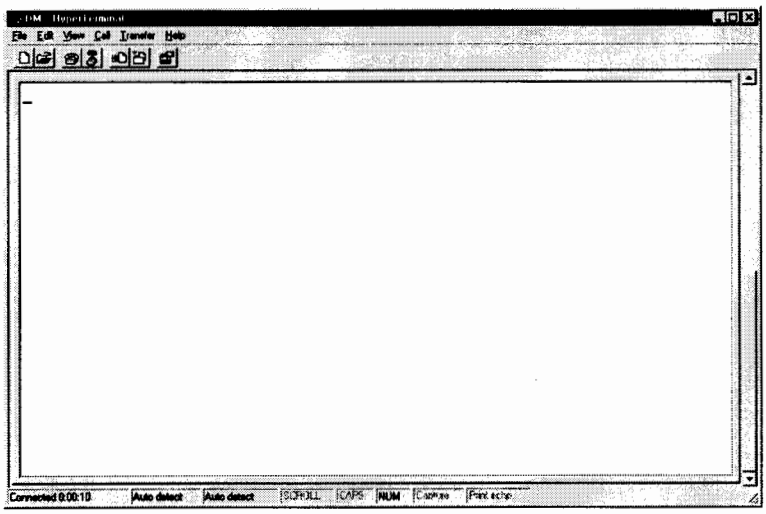


7. Operate the DM recorder unit, lifting the sensor unit up or down. All the data recorded will be output to your PC while the sensor unit is being driven. When the sensor unit is stationary, no data will be output.

To store the data, use the following procedure:

(1) Click "All" to select all data or select your desired data in the "Edit" menu.

(2) Click "Copy" and the data will be stored into the temporary memory in your PC. Activate your preferred application software (Excel, Word, etc.) to which the data to be copied and do "Paste" on a work sheet of the selected software.



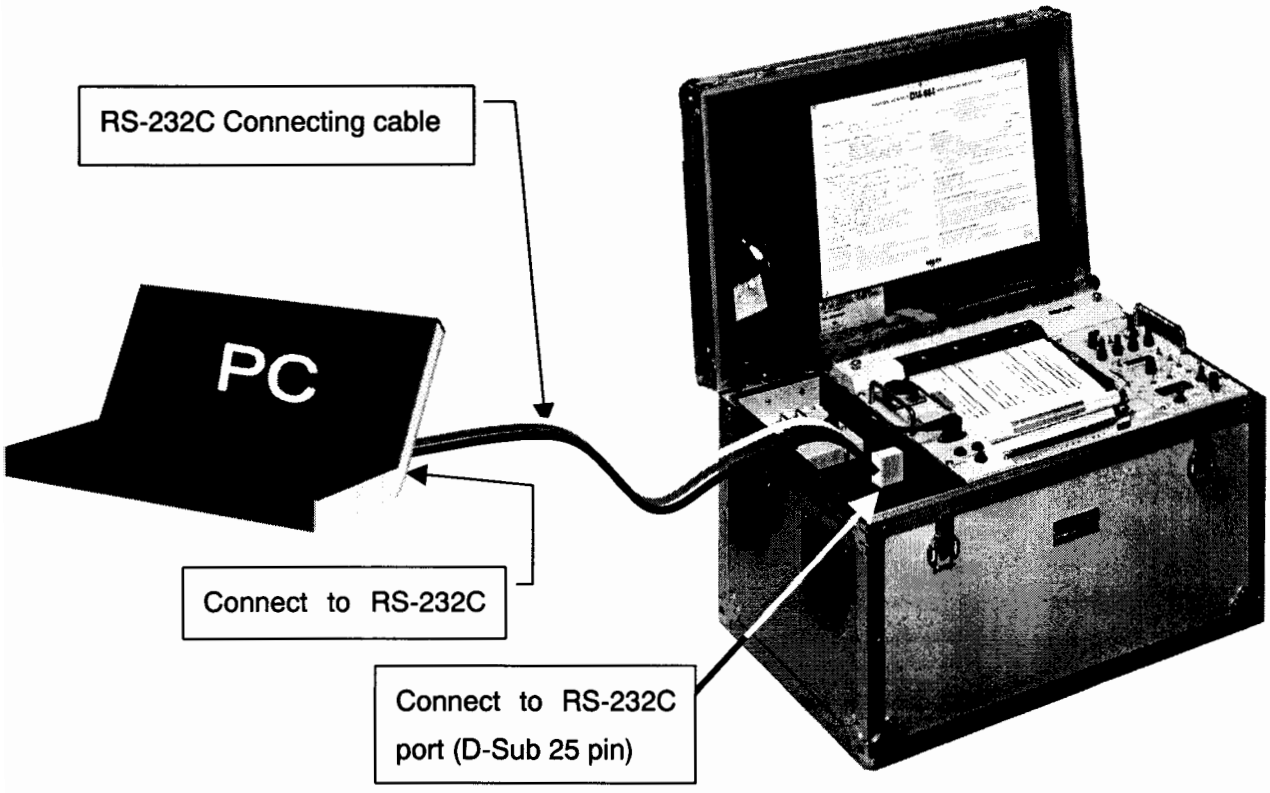


Figure 9.2 Connection between DM and PC

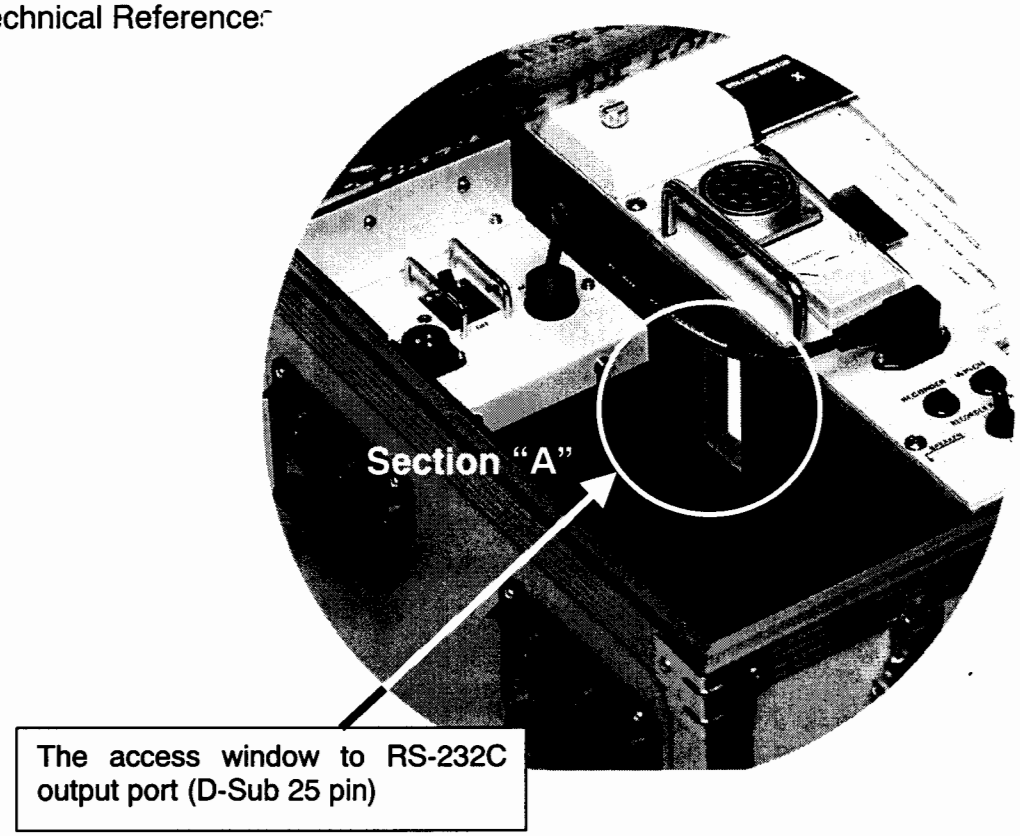


Figure 9.3 Location of RS-232C port on DM-602/604

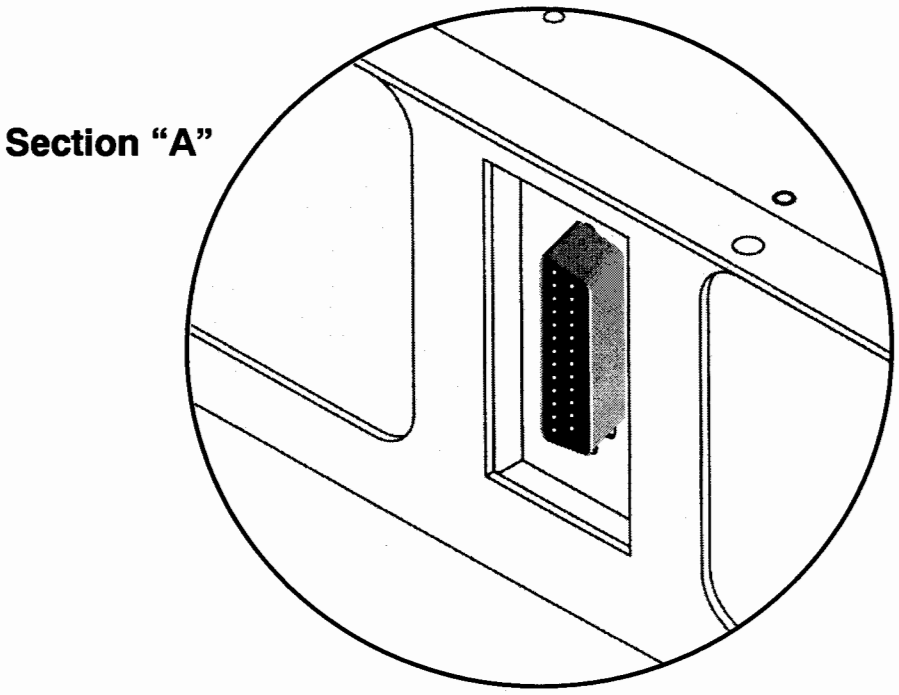


Figure 9.4 Details of Section "A" - RS-232C port on DM-602/604