Preface

Optical Mark Reader (OMR) is a high-tech data input computer peripheral that integrates optical, mechanical and electrical technology. It reads the information from the filled parts of form in the principle of the transform between optics and electricity, and then it transfers the information into computer through data cable. It solves the “bottleneck” of data input. It releases human from the heavy work of keyboard input. OMR reads thousands of information every second, and nearly no error. It is much more advanced than manpower.

OMR is named Examination Papers Reading (Scoring) Machine, which is well used and appreciated in standard examinations. Now OMR is popular in high schools, colleges and universities and it has gone into the following fields, such as Education, Industry, Agriculture, Personal Management, Election, Hygiene, Sports, Traffic and Communications, Taxation, Census, etc.

The application characteristics of OMR are: design forms uniformly, fill in marks dispersedly, input together and disposal quickly. According to the information collected to design and print the forms and program the relevant application software, and then dispense forms to fill in marks respectively. After that, collect the forms that had been filled in to read by OMR. At last, analyze and manage by computer so that it’s easy and correct to quickly collect and dispose a mass of information whose origin is dispersive and quantity is very large.

Our company is a professional enterprise, which produces OMR, relevant software and forms. Now, NANHAO Group has developed the following types of OMR: OMR40A, 40C, 40FD, 40BD，40CU etc. At present, our group has developed the new types of DSP OMR41/48. It has 50 routes “electric eyes” including the

double-sheet route and synchronous route. It has RS232 and USB two kinds of interfaces. Its photoelectric sensor doesn’t need to be adjusted. It can read bar code and the identification ability is precise. The advantage of our OMR is that it can share the resources with computer.

Thanks for your choice of NANHAO OMR.
Please read this manual book carefully before you use the machine!!

Catalogue

Chapter I OMR41/48 Characteristics And Main Techniques

1.1 The characteristics

Besides the characteristics of the OMR40C that can read forms of different sizes and sleep automatically in economical situation when wait for work, it also has the characteristics as follows:

1. High integration, it adopts advanced DSP chip. The functions of sheet feeding, scanning control, collecting and processing data and recognizing format are integrated here. Its function of processing data is stronger; the circuit is simpler, the capability is more stable and the reading speed is faster (about 2 pcs/sec, 21 x 29.7 cm).
2. It has two kinds of interfaces: RS232 and USB, it can communicate with general PC and notebook PC freely.
3. Photoelectric sensor does not need to be adjusted. The definition to electric sensors with the software is very easy.
4. Its photoelectric sensor has 50 routes “electric eyes”.
5. Improve the function of command system so that it’s simple and flexible to design the forms and format files.
6. Reading speed can be adjusted in eight grades.
7. Can identify 128 bar code.
8. Adopt the switch of wide input voltage. AC90V-264V,47-63Hz are all acceptable

1.2 The main techniques

1. The way of feeding: automatically and declining.
2. Reading speed: 2 pcs/sec at most, it can be adjusted in eight grades.
3. Form types:
   ① size: 130mm*50mm～300mm*210mm

② thickness: 70～150g/m2

③ error: overprinting ±0.1mm; cutting ±0.2mm

4. Types, track distance, route numbers, and photoelectric sensor:

Type	Track distance	Routes (Including D and S)	Photoelectric sensors
41FS	1/5 inch (5.08mm)	43	Only A sensor is on the face
41FD			Both A and B are on the face
41FBS			A is on the face, B is on the rear
48FS^{+}	1/6 inch (4.23mm)	50	Only A sensor is on the face
48FD^{+}			Both A and B are on the face
48FBS^{+}			A is on the face, B is on the rear

1. Marking tools:

Pencil read head: 2B or softer pencil and carbon pen;

Pen read head: pencils, pens and ball-point pens (non-red, non-white)

2. Size of mark: ≥2mm*1mm or 3mm*0.5mm, the standard size is 3mm*1mm

7. Error rate: ≤$1*10^{-7}$ (based on 3mm*1mm)

8. Double-sheet rate: ≤$2*10^{-3}$

9. Check rate: ≤$5*10^{-4}$

10. Mark choice: single-choice. Multi-choice and BCD code

11. Format: 26 kinds, each has 256 commands at most. The length of each data mode is 90 at most.

12. Host: all kinds of PC and notebook PC, Windows system

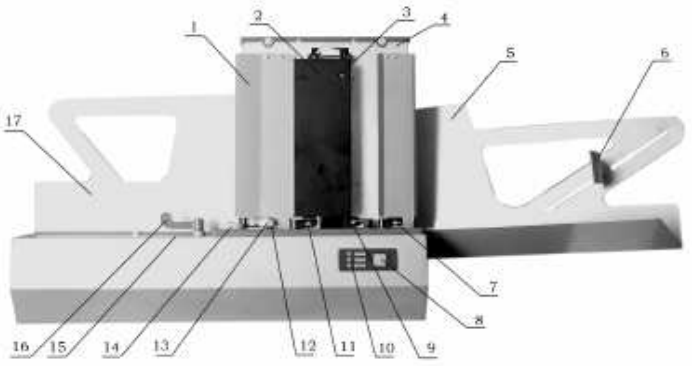
13. Interface: RS232 series and USB interface

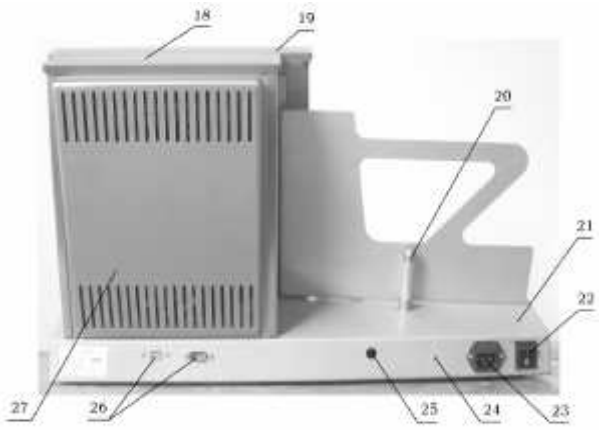
14. Power supply: AC90V～264V, 47～63Hz, ≤100W

15. External size: 610mm*250mm*475mm (without sheet exit tray)
16. Net weight: 8Kg

Chapter II Hardware Structure

The hardware structure can be divided into basic structure, power supply, mechanism transmission, main board and operation panel. As follows:





Picture 2.1 The outline of OMR

1.sheets entry guide board 2.photoelectric sensor
3.muti-sheet adjustment POT 4.bracing board
5.output stacker 6.blocking board
7.throwing wheel 8.sheet throwing button " step"
9. feeding wheel 10.pindicator light
11. feeding wheel 12. multi-sheet gap adjusting screw
13. separating wheel 14.sheet control-feeding wheel
15.sheet entry guide track 16.switch arm of input stacker
17.input stacker 18.top cover
19.bench 20. fixing screw for input stacker
21.body base 22. power switch
23. socket 24. earth screw
25. screw for input stacker pressure adjusting
26. communication interface 27.back cover

2.1 Basic structure

The basic structure is made up of body base, bracing board, top cover, bottom cover and back cover. All the parts of OMR are installed on the basic structure as following: the power supply and mechanism part are installed in the body base; operating panel is installed in the right side of the body base; bracing board is installed on body base; central control board is installed in the bracing board; photoelectric sensors is in the front of the bracing board. Bench can prevent the dust and strong light caused by photoelectric sensors and mechanism part.

2.2 Power supply

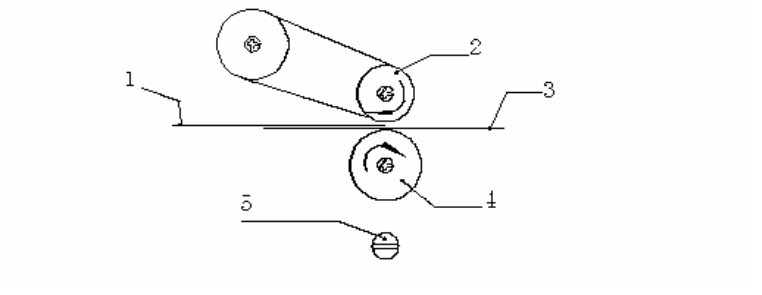
It adopts a switch power, which is installed in the OMR. It is supplied with alternating current AC90V~264V, 47~63Hz, output 12V and 5V.

2.3 Mechanism transmission

The part is made up of sheet rubbing motor, sheet feeding motor, input stackers and rubbing part, sheet separating part, sheet feeding part, sheet throwing part and output stacker. The function is to deliver sheets through photoelectric sensors one by one smoothly, and then place them in the output stacker.

Sheet rubbing wheel is driven by a DC motor. Sheet rubbing motor can circumgyrate deasil or widdershins. When OMR receives the reading order, the controlling part immediately drives the sheet rubbing motor to circumgyrate deasil. Sheet rubbing wheel rubs the top sheet and delivers it into sheet separating part under the photoelectric sensors. When the end of the first sheet leaves the sheet rubbing wheel, the sheet rubbing motor will pause and have short converse circumgyrate under the control, so that the next sheet will stop in time and it avoids the situation of double sheets.

Sheet separating part (as picture 2.2) has a front wheel that turn clockwise, and a pair of behind wheels that can only turn in the opposite direction. The distance of these two kinds of wheels can be adjusted by the adjusting screw, which should be between one-form and two-form thickness. Thus the former form can go through freely and the latter one is kept off. Multi-sheet problem will be avoided.



Picture 2.2 the sheet separating part

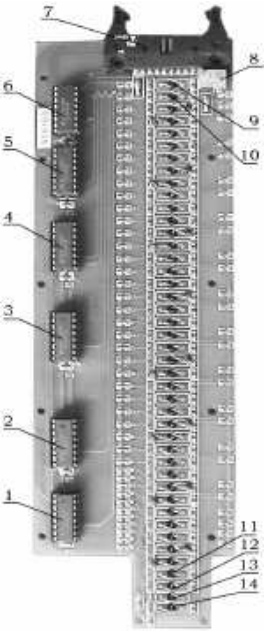
1. the latter form 2. the behind wheel
3. the former form 4. the front wheel
5. multi-sheet gap adjusting screw

The output stacker is in the right of bracing board. There is a blocking board whose direction can be adjusted. It can make sure that the forms can be placed tidily.

2.4 Photoelectric sensor

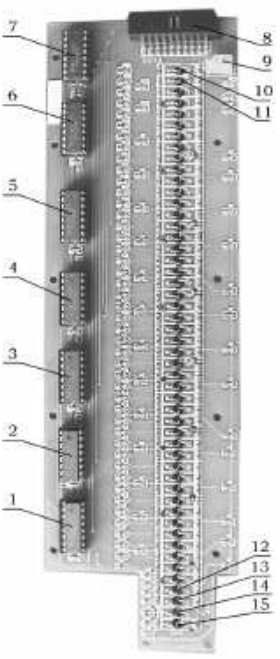
Photoelectric sensor is the main part of OMR regarded as the eye of OMR. Its function is to transform between optics and electricity. The sensor is composed of LST in raster, transmitting tube, resistance, and integrated chip. Taking the photoelectric sensor with 1/5-inch track distance for example, the route at the bottom is synchronous route (called S route for short), which is used to recognize the synchronous frame. On the top of S route is double-sheet route, which is used to examine forms' feeding and multi-sheets. The rest are tracks 1~41, which are used to read the data areas (marks). The top is track 41.

NOTICE: The D route of photoelectric sensors of 1/6 inch is at the bottom; S route is on the top of D route. The others are tracks 1~48.



1. Collecting chip (1-8 routes)
2. Collecting chip (9-16 routes)
3. Collecting chip (17-24 routes)
4. Collecting chip (25-30 routes and D, S routes)
5. Collecting chip (31-38 routes)
6. Collecting chip (39-41 routes)
7. Communication interface
8. Adjusting POT of D route
9. LST of 41 route
10. LST of 41 route
11. LST of 2 route
12. LST of 1 route
13. Transmitting tube of D route
14. LST of S route

Picture 2.3.1 Photoelectric sensor of OMR 41FS



1. Collecting chip (1-8 routes)
2. Collecting chip (9-16 routes)
3. Collecting chip (17-24 routes)
4. Collecting chip (25-30 routes and D, S routes)
5. Collecting chip (31-38 routes)
6. Collecting chip (39-46 routes)
7. Collecting chip (47-48 routes)
8. Communication interface
9. Adjusting POT of D route
10. LST of 48 route
11. LST of 47 route
12. LST of 2 route
13. LST of 1 route
14. LST of S route

Picture 2.3.2 Photoelectric sensor of OMR 48FS$^+$

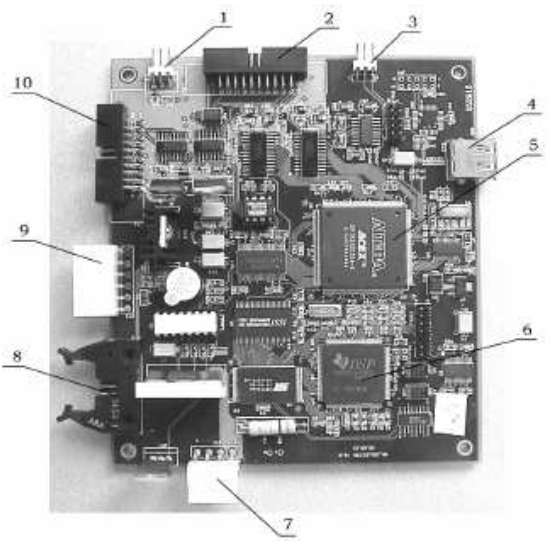
OMR41FD/48FD$^+$ are the types of machine that single side and read twice; OMR41FBS/48FBS$^+$ are the types that double sides and read once. These two series OMR both have the similar sensors (A and B). A has double-sheet route but B has no one. The arrangement order of "electric eyes" of A, B sensors' route is of the same to that of 41FS/48FS$^+$. A, B sensors of FD/FD$^+$ are both on one circuit board, A is on left and B is on right. But A, B sensors of FBS/FBS$^+$ are independent, A read front side and B read backside.

2.5 The main board

DSP Main board is the core of OMR. It is installed in the bracing board and communicated with power, photoelectric sensor, operation

panel, motor and computer by data wire and cable. It can control two motors of rubbing and feeding and control the photoelectric sensor to collect signals. At the same time, it can change the analog signals into data signals; it can deal with data and recognize the form's mode. It communicates with computer and receives the operation command. At last it transmits the results into computer.

Please refer to the picture as follows:

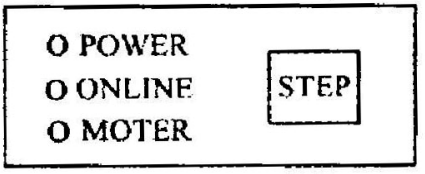


Picture 2.4 Main board of 41/48 series product

1. LST interface of D route
2. photoelectric sensor interface
3. RS232 interface
4. USB interface
5. FPGA chip
6. DSP chip
7. motor interface
8. operation panel interface
9. power interface
10. B photoelectric sensor interface

2.6 The operation panel

The operation panel consists of 3 indicator lights and “STEP” button for sheets throwing. Red light “POWER” shines means power on, yellow light “ONLINE” shines means the connection is good between OMR and host, green light “MOTOR” shines means motor is working. The “STEP” button is used to throw out the sheet that is blocked under the sensor.



Picture 2.5 Operation panel

Chapter III Installation And Operation

3.1 Hardware installation

1. Take out the machine from package and put it on the desk lightly carefully.

2. Install output stacker:

Hang the output stacker on the screws that on the right side of the main board. Please refer to the picture 3.1:

Picture 3.1 Output stacker and blocking board

Adjust blocking board: The flume on the right side of the output stacker is used to fix the blocking board. User can fix it at the right position in the flume according to the size of the forms.

1. Installation with serial interface communication:

◆ Make sure that the computer and OMR are both in the estate of closed.

◆ Connect the power wire of OMR.

◆ Connect the serial interface of OMR to the computer's serial interfaces COM1 and COM2.

◆ Switch on the OMR power, you will hear a sound "toot", it means that the device is self-detecting. In the meantime, the power indicator light shines. Then, there will be two short sounds from the buzzer, it denotes that the self-detection is successful and you can continue the next connecting operation. The installation is finished.

Please refer to the picture 3.2:

Picture 3.2 Connect OMR and computer

1. Installation with USB communication:

USB device is plug and play. You can connect the communication wire in any time.

Switch on both of the OMR and computer; install the USB device driver first. The device driver needs to be installed only once, and then you can use it directly after the machine start-up. When you see **NANHAO USB OMR DEVICES** in the taskbar, you can operate the program.

The process of installation is as follows:

Install the USB device driver. The installation process is as follows:

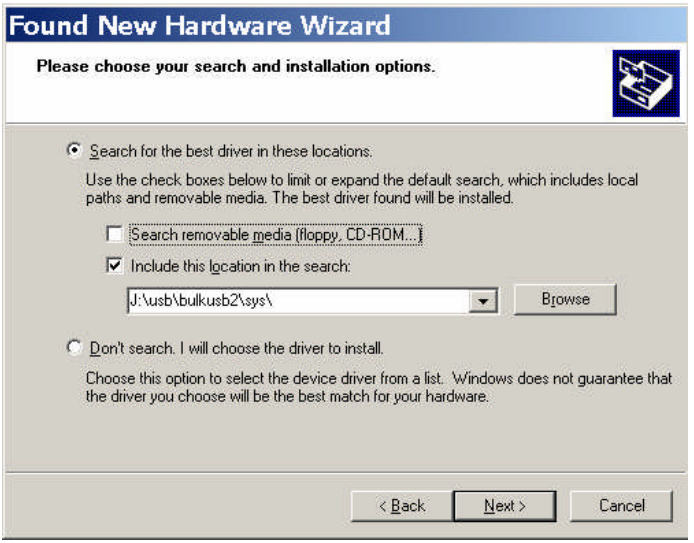
Insert USB communication wire. Windows system will detect the new hardware automatically and appear the dialogue box:

Picture 3.3

Then choose “Next” to continue.

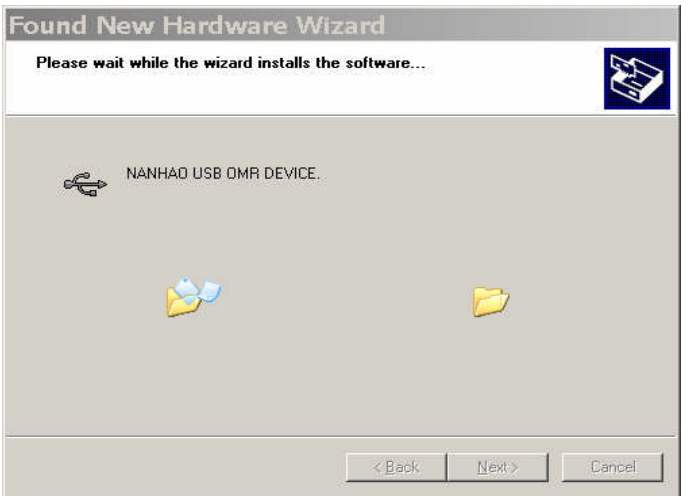
Picture 3.4

Choose “install the software automatically (recommended)” to install automatically or choose “install from a list or specific location” to install by your self. Click “Next” button and appears the following dialogue box: (Take the installation by hand for example).



Picture 3.5

Choose “search for the best driver in these locations” and choose the right path where the driver is. Click “Next” to start to install. As following picture:

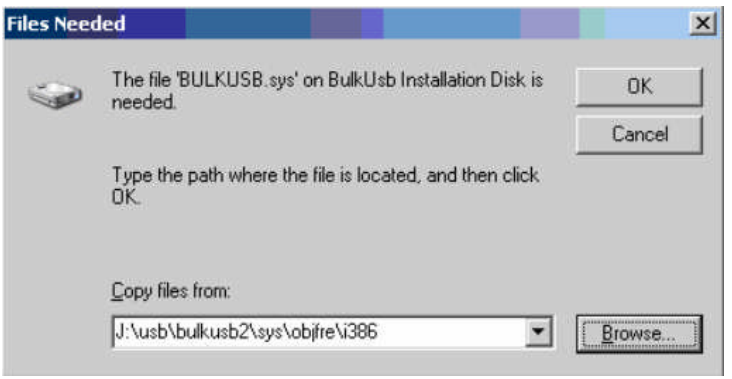


Picture 3.6

There is the notice during the installation process, choose "Continue Anyway" to continue the installation.

Picture 3.7

There could be the following notice that asks you to choose the path of the driver files.

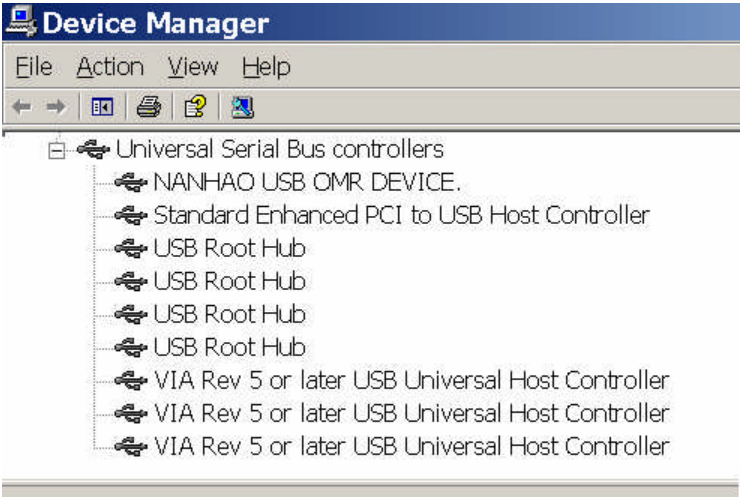


Picture 3.8

When the installation is finished, the following picture will appear:

Picture 3.9

Click “Finish”，you can find “NANHAO USB OMR DEVICE” in the device manager. It denotes that the installation is successful.



Picture 3.10

NOTICE:

① Don't connect RS232 and USB at the same time.

② If you want to insert or pull out the RS232 cable, you must turn off the power first. Otherwise, you will destroy the ports.

③ The power must fit AC90V～264V, 47～63Hz. In order to ensure the security and normal, the crust should be well connected with ground. The power socket should be with three holes. Otherwise, there should be ground cable from OMR crust.

3.2 Software Installation

There is a CD enclosed in the OMR packaging case. It includes the Test Program and Grading System. As for the installation details and specifications please refer to chapter V 5.3.2.

3.3 Operation

1. Online

Operate the program (NANHAO OMR Test Program or Grading

System) and make the machine online, then you will hear the sound and see the indicator light shines. Now, you can begin reading with the machine.

2. Operation

Put the forms into the input stacker:

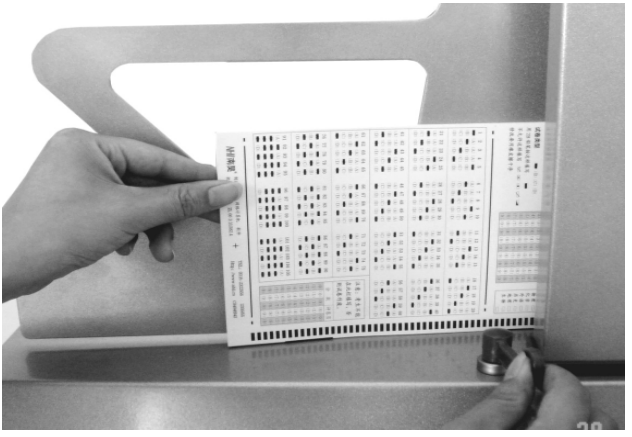
First, you should make the forms in order. Turn the handle anticlockwise to open the input stacker. Put the forms in it with the synchronous frame below and the face is frontward. Push them against the main board.

Refer to the picture 3.11. Turn back the handle clockwise.

The forms of our company are all cut a corner, generally the top right corner. It makes users clear up the forms conveniently. Please notice that the number the forms that you put into the input stacker at a time should not exceed the capacity.

Reading:

Now, you can operate the Grading system software and load format files to prepare for the reading. During the reading process, each form will drop into the output stacker smoothly. After reading, scores statistics and printing can be continued.



Picture 3.11 Input forms

Chapter IV Command System

In order to make the OMR read various forms conveniently and neatly, here we offer a set of integrated command system, which includes controlling commands and forms definition commands.

4.1 Command format definition and related regulation

1. Command format definition.

The commands of NANHAO OMR format documents are made up of identifiers, parameter and ending sign. The common mode of the commands usually is:

command identifiers parameter1 parameter2… parameter n/

Command identifiers are composed of an English letter, a sign or three figures to show the meaning of the command. Several groups parameters are allowed and each group is composed of a capital letter, a sign or several figures; "/" is command ending sign. They are separated by space bar between command identifiers and parameters and among parameters. All letters in commands must distinguish from capitalization and small letter.

The explanations about how to use these commands are as follows:

"{ }" sign, means that the content in parentheses is variable for choice, one of them must be chosen.

"[ ]" sign, means that the parameter in it can be chosen or omitted.

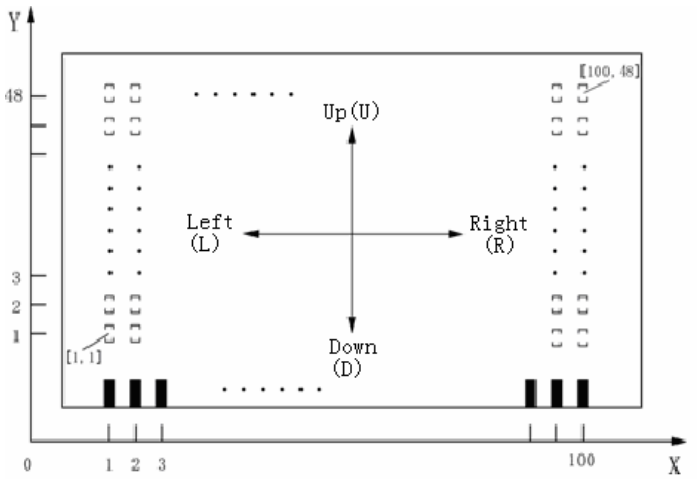
"n" or "nn" denotes the bits of the parameters, if the bits number

of the parameter chosen by user are fewer than the set number it is needed to add “0” before parameter to complement the bits.

“ ” Denotes space bar.

2. About the regulation of forms

As for the command system of forms, the regulation on the problems of information bits’ coordinates and the data arrangement is as follows: synchronal frame is at the bottom of the forms, X is the ordinal number of the form synchronal frame, the ordinal number of the first synchronous frame from the left side is 1, the maximum ordinal number of synchronous frame can reach 100; Y is the ordinal number of form information bit in upright direction. It is decided by the ordinal number of the photoelectric sensor’s “electric eyes” which is corresponding with the information bits. (Picture 2.3 is for reference). The maximum of Y is decided by the number of “electric eyes” that are included in OMR machine. For example the Y’s value of “ OMR48 series” is 48. Up (U), down (D), left (L), right(R), as picture 4.1.



Picture 4.1 Regulation of forms

3. Specification of data buffer.

The data buffer of this series OMR is 1.5K bytes and it is used to store the forms data after reading. Users can read any character string with any length and position in buffer through command. The first byte in data buffer is a special definition sign. From the second byte, they are the information character strings that read forms. The special definition sign is obtained automatically by the machine according to the forms format style.

4.2 Controlling commands

1. Reading command "/" or "R/"

This command is designed for controlling OMR to read forms. Every time sending a command, OMR will read a form. If you send commands continuously, then the machine will read forms continuously. It can return the current reading state after finish reading one form. If the return value is "OK", it means that reading data is effective; if the return value is "00～99", it means reading error. The data is error code. (Refer to error code appendix)

When using the machine with two photoelectric sensors, command "/" expresses only photoelectric sensor A is in the state of reading; command "R/" expresses both A and B photoelectric sensors are in the state of reading.

2. Reading data command

"nnnn mmmm /" or " $\left\{\begin{matrix}A\\B\end{matrix}\right\}$ r [nnnn mmmm] /"

After OMR read a form, there will be a character string by data processing and it will be saved in the data buffer, so that the

application program of users can read it. This command's function is to read data from data buffer to application program.

The first parameter "A", "B" mean A, B photoelectric sensors. 48FS^{+} can only choose A.

The second parameter "nnnn" expresses the first position where data is in buffer.

The third parameter "mmmm" expresses the length of read data.

The range of "nnnn" and "mmmm" are both from 0001-1500.

If you need the number of synchronal frame, you can send command "rA/" expresses that it will read the synchronous frame number of forms that go through A photoelectrical sensor. It doesn't need to choose the second and the third parameters.

3. Format file command "S the name of format file/"

The function of this command is to input the format file or format file command into format area defined by OMR before reading forms, so that endue the function of reading forms. Parameter format files are divided into two kinds: first, if it only shows the name of file, such as "a.txt", it demands that this file should be in the same path with application program. Second, you can put the format files in any paths, it demands that the file's name must be the format file's absolute path, such as "c:/a.txt".

4. Output code choosing command "+ $\left\{\begin{matrix}1\\2\\3\end{matrix}\right\}$ [C [M]]/"

This command can choose multi- choice output code. The choice "1" expresses NHOMR series code, "2" expresses national standard (GB) code, "3" expresses England DRS standard code (refer to appendix chart). Parameter "C" is an optional item, it can be used to define that the output code of unmarked dots. If you don't choose this item, it will be standard output. When you choose

"M" it will only choose the mark whose grade of gray is the highest to output, but not distinguish the multi-marked dots.
If you don't use this command, the default output code will be NHOMR series code.

5. Format area initialization command "B/"

This command is used to initialize the format area. When install the format files and commands into format area, user should initialize the format area first by using this command. Otherwise it may cause error. It will report "no format" error without this command.

6. The command of adjusting gray's grade.

"G MM NN mm nn/"

Use this command to adjust the identification standard of OMR, so that it can improve the exactness of reading.

"MM" is the gray of detection dot and line, it's generally about 03.

"NN" is the gray of mark; it's generally about 02.

"mm" is the single-option adjustable value, this value can eliminate the interferential factors such as the wrong mark didn't been erased completely when it deal with single choice, and then to judge to single mark or double marks. If the margin of two marks' gray is in this range then it will be judge double and output ">"; if the margin is larger than this value then it will be judge mark single, it will only read the larger one. This value is generally from 01 to 03.

"nn" is the multi-option adjustable value, this value is used to eliminate the interferential marks. In the range of mark gray, if one item gray is not bigger than the multi-choice adjustable value that is the mark, however, if the gray grade value error of marks is

larger than the multi-choice adjustable value, and then these marks will be eliminated.

The ranges of above four parameters are all from 01 to 15.

This command is generally set as “G 03 02 02 05/”

7. The command of adjusting reading speed “MO m/”

The range of parameter is from 1 to 8, namely eight grades adjustable speed, 1 is the fastest and 8 is the slowest.

8. The command to define the modulus of sheet rubbing time

Frontward turning “m N [S]/”, backward turning “M N [S]/”

The value of “N” is generally from 0 to 9. It expresses reducing if choose “S” and expresses addition without “S”. If the machine can’t work well such as paperboard you can increase the modulus of frontward turning; if the double-sheet error rate is higher you will increase the modulus of back turning; if forms are thrown back, it expresses the modulus of back turning is big, you should decrease it.

4.3 Form definition commands

1. Format sign definition command

This command is used to define form’s format sign. OMR can choose the relevant format file to read the forms according to the format sign, so that many kinds of forms can be read together.

① Format sign definition command

T { A / B / ・ / ・ / ・ / Z } xxx yy /

The first parameter is the name of form’s format sign. There are 26 kinds to choose form A to Z. “XXX YY” is the coordinates of this

sign.

② Compound format sign definition command

T nn xxx yy { U / D / L / R } /

Compound format sign is as follows:

It is composed of six continuous info-bits. The first one is sign bit. It must be marked into black. The other five info-bits express sequential the number of 1, 2, 4, 8, 16. “XXX YY” is the coordinates of sign bit. U, D, L, R (up, down, left, right) express the direction of compound format sign from sign bit. “nn” is the ordinal number of format sign, it’s range is from 01 to 26. The ordinal number 01 to 26 corresponds to input A to Z 26 letters in all. “nn” should be equal to the summation of 1, 2, 4, 8, 16 you have marked.

NOTICE: ① The format sign is used to distinguish different forms. So the format sign of different forms should be different from each other. If it’s the compound sign, then the format ordinal number must be different from each other, that is to say the compounding of marks should be different from each other, but the position of the first dot (the position of X axis is from right to left) and the direction of arrangement should be consistent. If it’s not the compounding sign then their position should be different from each other. If the coordinate of Y-axis is not consistent with each other then the position of X-axis from right should be not consistent.

② When you want to read forms of different sizes together, the format sign should be designed on right of sign frame in order to separate forms. The sign frame is the synchronous frame which is13 cm distance from left.

③ X axis's coordinate of format sign should not be 1. If it's double-side form, it can't be on the last synchronous frame.

2. Dot matrix definition command "L xxx yy ll /"

This command is used to define forms' dot matrix. "xxx" is the number of forms' synchronous frame ; "yy" is the topside routes number of forms; "ll" is the number of sign frame, it's the number of synchronous frame from the lower left to the point where is 13cm distance far. It is to control paper separating. If the number of sign frame is set too small, it will cause double-sheet error. If the number is set too large, it will cause the paper block.

3. Detecting dots and line definition command "M xxx yy YY /"

There are some vertical black dots and lines on forms. When OMR works, it can detect these dots and line. If it can't detect these, it expresses that OMR are working wrong and it will send error alert. These dots and line are named detecting dots and line. This command is used to define the coordinate of detecting dots and line.

"xxx" is the X axis coordinates of detecting dots and line; "yy YY" are the starting and ending coordinates from Y axis, it's generally "yy" < "YY". There are the dots and line from "yy" to "YY", if there is an empty you must define subsection. If "yy" = "YY" then define a detecting dot. It doesn't permit "yy" > "YY", otherwise, it will cause error.

There are two "M" commands. If there is only one detecting dots and line, you can define again or do subsection definition.

4. Data mode definition command

"D $_{nn}$ $S_1S_2…S_m$ /"

This command is used to define all the different data modes on forms. So-called data mode is a group of data options, which is composed of several bits on forms. Every bit expresses an option used by marker to choose. OMR can read the data that have been marked from these options. The expressing form of these data group is data mode.

The first parameter of command "$_{nn}$" is the data serial number; its range is from 01 to 99.

The second parameter is the content of the defined data mode, "$S_1S_2…S_m$" is generally made up of 0 to 9 ten numbers or A to Z 26 English letters. There is a space bar between data or letters. The total length of data mode does not over 90. The space bar expresses that this information bit can't be read. The position and quantities of space bar among commands must be consistent with reality.

Such as: D 10 0123456789/
D 02 A B C D/
D 03 ABC….XYZ/

5. Data module definition command

"F xxx yy { U D R L } { S s M m B b } nn XX { U D L R } [1]/"

This command is used to define one of the data modules on forms. The data module is data matrix that is arranged according to the same rule with the same data forms.

Among commands, the first and the second parameters "xxx yy"

define the jumping-off point coordinates.

The third parameter U(up), D(down), L(left), R(right) expresses the arrangement direction of the data form from the jumping-off point.

The fourth parameter is the identification mode:

“S”: Expresses single-option. That is only to choose one filled point from a data form. If the marker fills several points then it will output “>”.

“s”: Expresses single-option. If the marker fills several options it will output multi-option code, but not output “>”.

“M”: Expresses multi-options. Markers can choose several points to fill in and output multi-options code. The length of data mode should not be more than 5. (Space bars are not included)

“m”: Expresses multi-options, the length of data mode can be 7, such as [A][B][C][D][E][F][G], the total number is 7. If the marker fills in A and C, it will output “AC * * * * * ” according to the practical situation.

“B”: Expresses that to distinguish according to BCD code. The data mode of BCD code is fixed to be 8421; It will output 0 if marker fill 8 and 2 or fill nothing.

“b”: Expresses to distinguish according to BCD code but the data mode is 84210. At that time, it will output “0” if you fill in 0; it will output “>” if you fill 8 and 2; and it will output “·” if you fill nothing.

The fifth parameter “nn” is data mode serial number and this serial number must be consistent with that in the data mode definition command.

“XX” expresses the number of the same data mode, which compose the data module.

The seventh parameter U(up) D(down) L(left) R(right) expresses

the arrangement and extension direction of the data module from the first data mode.

The last parameter “[1]” expresses that there is one blank row between the neighboring data modes in the data module. There is no blank row among data modes without “[1]”, and then it will continue to arrange.

4.4 Format file

Format file is a command file that is used to define the information format and control the forms reading. It is the combination of controlling commands and form definition commands. Commands that are included by format files can be divided into public command and special command. Their arrangement order is commonly: public command, special command for A form style, special command for B form style etc. Format file must begin with the initialization command.

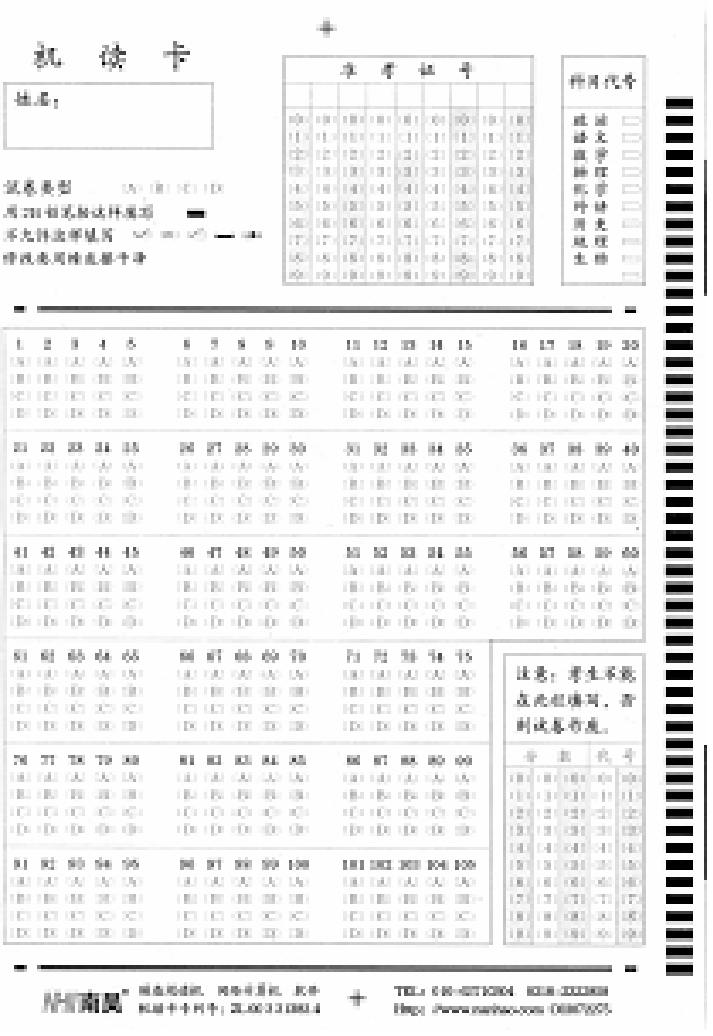
Public command of format files

Command name	Command mode
Initialization	B/
Gray degree adjustment	G MM NN mm nn/
Output code option	+ {1 2 3} [C[M]]/
Data mode definition	D_{nn} $S_1S_2\cdots S_m$/

Special command of format files

Command name	Command mode
Format sign definition	T {A B · · · Z} XXX YY/ or Tnn xxx yy {U D L R} /
Detecting dots and line definition	M xxx yy YY / (must be two commands)
Dot matrix definition	L xxx yy ll/
Data module definition	F xxx yy {U D R L} {S s M m B b} nn XX {U D R L} [1]/
Bar code definition	f m xxx XXX YY nn/

The following picture is 105 options form and its format file:



B/
G 03 02 02 05/
D 01 0123456789/
D 02 ABCD/
T A 046 19/
M 001 01 23/
M 039 01 23/
L 051 23 38/
F 050 13 L S 01 06 D/
F 050 13 L S 01 09 D/
F 012 05 L S 01 03 D/
F 050 01 L S 01 01 D/
F 036 23 L S 02 05 D/
F 036 17 L S 02 05 D/
F 036 11 L S 02 05 D/
F 036 05 L S 02 05 D/
F 030 23 L S 02 05 D/
F 030 17 L S 02 05 D/
F 030 11 L S 02 05 D/
F 030 05 L S 02 05 D/
F 024 23 L S 02 05 D/
F 024 17 L S 02 05 D/
F 024 11 L S 02 05 D/
F 024 05 L S 02 05 D/
F 018 23 L S 02 05 D/
F 018 17 L S 02 05 D/
F 018 11 L S 02 05 D/
F 012 23 L M 02 05 D/
F 012 17 L M 02 05 D/
F 012 11 L M 02 05 D/
F 006 23 L M 02 05 D/
F 006 17 L M 02 05 D/
F 006 11 L M 02 05 D/

Specifications:

① OMR read the character string according to the compile order of the format files. The compile order of the format files commonly is: format sign, exam number, subjective score, subjects, results and so on.

② The number of questions can be partly defined according to need. Users should define single-option or multi-option according to need. This example here defined 105 problems and from 1 to 75 are single-options, from 76 to 105 are multi-options.

③ Here the example only compiled the format file whose format sign is A.

Chapter V OMR Testing Program

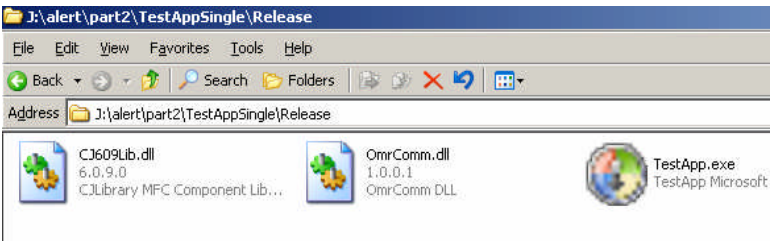
5.1 The demand of the system

1. Resolution: more than 800*600, recommend 1024*768
2. RAM: more than 128M

3.Operating system: windows 98, windows 2000, windows XP, or windows 2003.

5.2 The preparation before running

Make sure that there are the following files under the running catalogue: CJ609 Lib.dll, OmrComm.dll as the following picture:



Picture 5.1

5.3 The application of testing program

1. The introduction of the main interface:

The main interface of 48FS^{+} testing program is as the following picture 5.2. You can operate the program through menus or the navigation item on the left.

① “Setting” menu includes:

Configuration: Set the correlative quotiety of online operation and reading setting.

Definition: Adjust the working quotiety of the photoelectric sensors by software.

② The “Test” menu includes:

Instantaneous Value Test: To examine the collected data from every photoelectric sensor route.

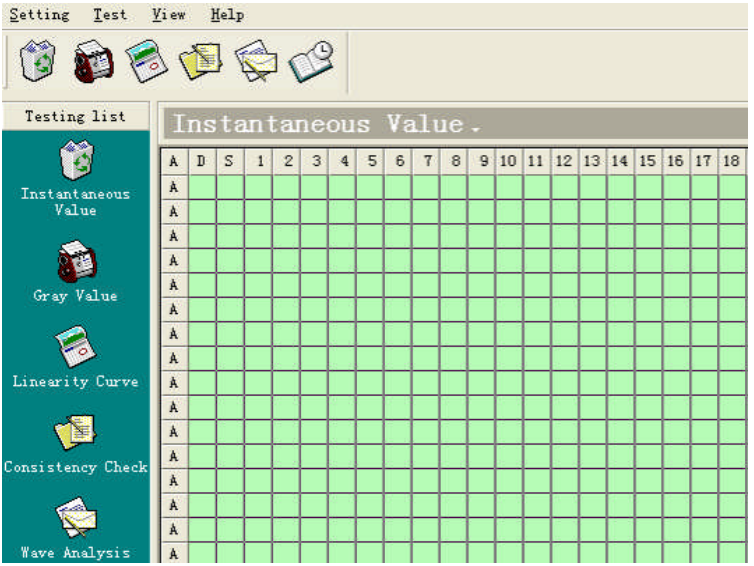
Gray Value Test: To show the gray value of information bits after reading a form.

Linearity Curve Test: To show the gray value curve of all information bits on one track of photoelectric sensor according to the gray value.

Consistency Test: To show the gray value curve of all information bits to one synchronous frame according to the gray value. The size and the color of all the information filling bits are the same.

Wave Test: To show the curve of the instantaneous value collected by synchronous route and certain photoelectric sensor route according to reading one form.

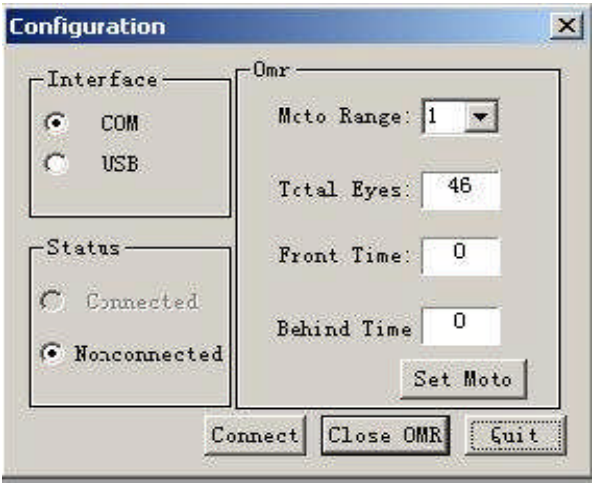
Reading Test: To check the running capability of the machine.



Picture 5.2

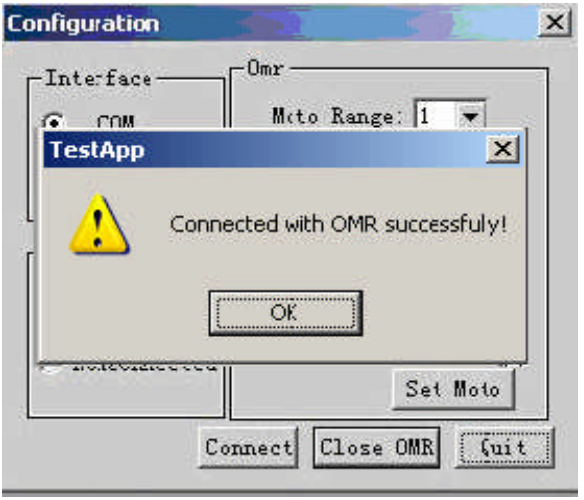
2. “Setting” operation

★ “Setting” is a necessary procedure before starting other operations. The process is as the follows: Click “setting” button, there will be a pulldown menu; click “configuration” and you can see the dialogue box as picture 5.3:



Picture 5.3

Choose the connect interface according to your need. Click “COM” (or “USB”) and “connect” button, interface “open COM” (or open “USB”) will appear. Click “confirm”, there will be one short and three longer sounds from OMR. And then inform you that “connected with OMR successfully!” as picture 5.4. Click “OK” to finish the operation.

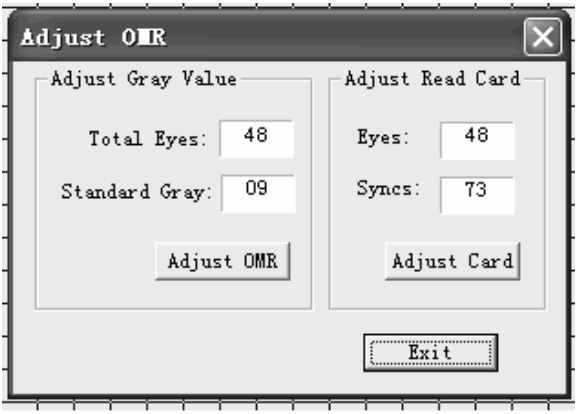


Picture 5.4

★ You can also set the correlative parameter of the sheet feeding by clicking the buttons “Moto Range” (from 1 to 8, gradually slower), “Front Time” (from –9 to 9, minus value is to reduce the forward running of the rubbing motor, otherwise to increase.) and “Behind Time” (from –9 to 9, minus value is to reduce the inverted running time of rubbing motor. Otherwise to increase). Click “Set Moto” to make the setting effective.

Remark: The motor setting has been set well before leaving factory. You should use it only when feeding trouble appears.

★ In order to make sure the veracity of the reading; Please do the operation “Definition” before reading. As picture 5.5.



Picture 5.5

"Adjust Gray Value": The purpose of the operation is to confirm the gray value of the standard marks read by photoelectric sensors. You must use the "standard test form" provided by the NANHAO Company, "Standard Gray" to express the gray value of the standard filled area, which is set to be 9 or 10 usually. "Total Eyes" expresses the routes number of the photoelectric sensor to be adjusted including the synchronous route and multi-sheet route.

"Adjust Read Card": The purpose of this operation is to check the judge standard of feeding form and double forms. You must take this operation with the forms that will be read before reading. "Syncs" refers to the total numbers of the synchronous frame on forms. "Eyes" value should be no more than "Total Eyes" value, but no less than the total routes of the forms.

Please put the forms that are ready to be used in this operation in input stacker, then completing this process by clicking the buttons "Adjust OMR" and "Adjust Card" respectively.

3. Instantaneous Value Test

It is used to detect the instantaneous values collected by each photoelectric sensor routes in order to judge the work statement of the photoelectric sensor.

It indicates that every route of photoelectric sensor work well in the following conditions:

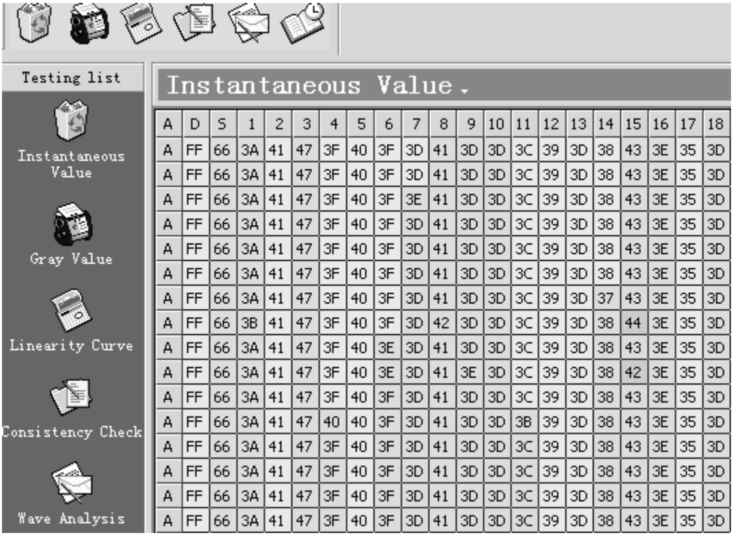
Put a blank sheet under photoelectric sensors, then all routes instantaneous values are 60~FF. They change in the scope of ±2 when the sheet stay still; They change greatly when the sheet moves. It indicates that all the sensors work normally.

To the instantaneous value of D route, it should reach FF in the condition that there is no form under photoelectric sensors; it should be far below FF in the condition of that there is a form under photoelectric sensor (Remark: you should make sure that the instantaneous value of two forms is clearly below that of one form). The value of D route can be adjusted by adjusting the exact POT. (as the Picture 2.1, Picture 2.3 and Picture 6.8)

The instantaneous value ought to change clearly when forms move under the photoelectric sensor, and the value about black filled bits ought to be far below that about unfilled ones.

Don’t press the operation panel in the front of OMR in the process of reading instantaneous values. If you do this, it may likely bring the result of reading mistakes, then you have to restart OMR to make everything normal.

(Please refer to Picture 5.6. Remark: the instantaneous value is in the form of hex.)



A	D	S	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3E	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	37	43	3E	35	3D
A	FF	66	3B	41	47	3F	40	3F	3D	42	3D	3D	3C	39	3D	38	44	3E	35	3D
A	FF	66	3A	41	47	3F	40	3E	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3E	3D	41	3E	3D	3C	39	3D	38	42	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	40	40	3F	3D	41	3D	3D	3B	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D
A	FF	66	3A	41	47	3F	40	3F	3D	41	3D	3D	3C	39	3D	38	43	3E	35	3D

Picture 5.6

4. Gray Value Test

It can show the gray value information of every info-bit through reading a form (Picture 5.7). We can judge the linearity and consistency from the gray value of reading the standard test forms, and we can also judge that if the photoelectric sensor is in the right position.

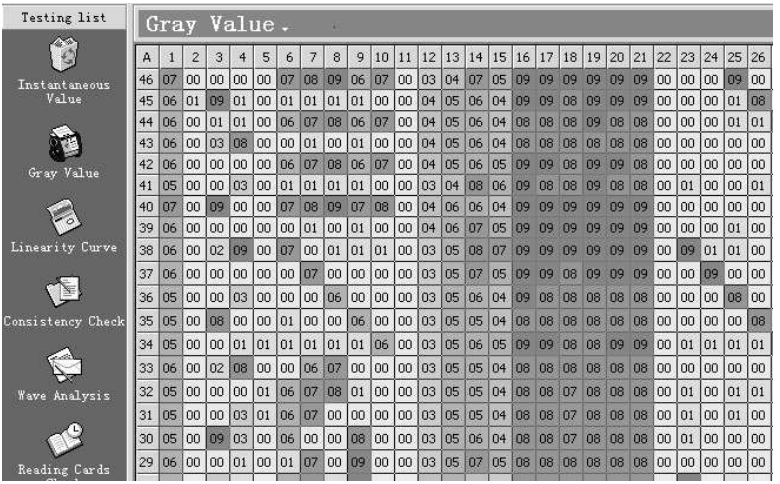
“Syncs”: refers to the total number of the form’s synchronous frames.

In the Picture 5.7, there is a part of gray value information of the read standard test forms. We take this picture for an example to explain how to adjust the position of the photoelectric sensor.

When adjusting the lengthways position, you can refer to the gray value of track12 to track15. If the gray value of track13 and track12 is bigger than that of track14 and track15, then it indicates that the position of the photoelectric sensor is too low. You should

loose the screws on the top of the photoelectric sensor to adjust the photoelectric sensor upwards; on the contrary, it indicates that the position of the photoelectric sensor is too high, and you should adjust it downwards. At last, the difference between the track13 and track14 should be no more than ±2. When adjusting the lengthways position, you had better observe the routes in the middle part (such as route11-route20), in order to giving attention to both upside and downside and reduce the effect caused by accumulating error.

When adjusting the transverse position, you can refer to the gray value of track18 to track21. If the gray value of track19 and track18 is bigger than that of track20 and track21, then it indicates that the position of the photoelectric sensor leans to left. You should loose the screws on the top of the photoelectric sensor to adjust the photoelectric sensor rightwards; on the contrary, it indicates that the position of the photoelectric sensor leans to right, and you should adjust it leftwards. At last, the difference between the track19 and track20 should be no more than ±2. When adjusting the transverse position, you had better observe the routes in the upper part so that the result is more sensitive.



A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
46	07	00	00	00	00	07	08	09	06	07	00	03	04	07	05	09	09	09	09	09	09	00	00	00	09	00
45	06	01	09	01	00	01	01	01	01	00	00	04	05	06	04	09	09	08	09	09	09	00	00	00	01	08
44	06	00	01	01	00	06	07	08	06	07	00	04	05	06	04	08	08	08	09	08	08	00	00	00	01	01
43	06	00	03	08	00	00	01	00	01	00	00	04	05	06	04	08	08	08	08	08	08	00	00	00	00	00
42	06	00	00	00	00	06	07	08	06	07	00	04	05	06	05	09	09	08	09	09	08	00	00	00	00	00
41	05	00	00	03	00	01	01	01	01	00	00	03	04	08	06	09	08	08	09	08	08	00	01	00	00	01
40	07	00	09	00	00	07	08	09	07	08	00	04	06	06	04	09	09	09	09	09	09	00	00	00	00	00
39	06	00	00	00	00	00	01	00	01	00	00	04	06	07	05	09	09	09	09	09	09	00	00	00	01	00
38	06	00	02	09	00	07	00	01	01	01	00	03	05	08	07	09	09	09	09	09	09	00	09	01	01	00
37	06	00	00	00	00	00	07	00	00	00	00	03	05	07	05	09	09	08	09	09	09	00	00	09	00	00
36	05	00	00	03	00	00	00	06	00	00	00	03	05	06	04	09	08	08	08	08	08	00	00	00	08	00
35	05	00	08	00	00	01	00	00	06	00	00	03	05	05	04	08	08	08	08	08	08	00	00	00	00	08
34	05	00	00	01	01	01	01	01	01	06	00	03	05	06	05	09	09	08	08	09	09	00	01	01	01	01
33	06	00	02	08	00	00	06	07	00	00	00	03	05	05	04	08	08	08	08	08	08	00	00	00	00	00
32	05	00	00	00	01	06	07	08	01	00	00	03	05	05	04	08	08	07	08	08	08	00	01	00	01	01
31	05	00	00	03	01	06	07	00	00	00	00	03	05	05	04	08	08	07	08	08	08	00	01	00	01	00
30	05	00	09	03	00	06	00	00	08	00	00	03	05	06	04	08	08	07	08	08	08	00	01	00	00	00
29	06	00	00	01	00	01	07	00	09	00	00	03	05	07	05	08	08	08	08	08	08	00	00	00	00	00

Picture 5.7

5. Linearity Curve Test

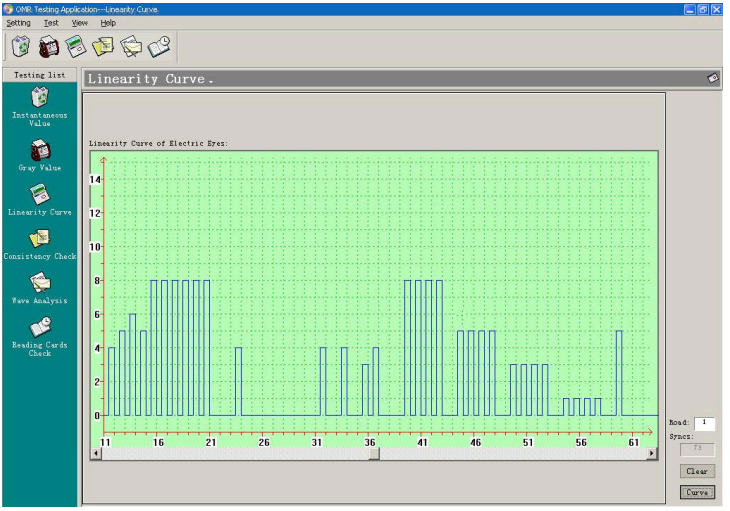
Linearity Curve is gained by analyzing the collected gray value. It indicates the work function of certain route of photoelectric sensor. The gray values are different because of the difference of the filled points' darkness and size. The darker the points are filled, the bigger gray value is; the larger the areas are filled, the bigger gray value is. So the gray values read by the same route photoelectric sensor appear linearity change, and the Linearity Curve is protracted according to this principle.

"Road": the route number of photoelectric sensor to be checked.

"Syncs": the number of form's synchronous routes.

As the following Picture 5.8, it is the linearity curve of the integrated checking form by a certain route of photoelectric sensor. In the checking form, the gray degree of filled points of track40 to track58 of synchronous frames is lighter gradually, and their gray values will be four ladders. We can know from the picture 5.8 that the collected values accord with the fact. Therefore, it proves that

the work of the photoelectric sensors is normal. Other routes of photoelectric sensors can be judged by the same method.



Picture 5.8

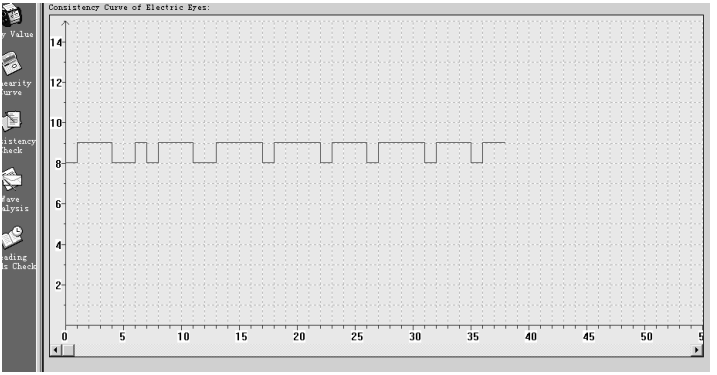
6. Consistency Test

Consistency appears the gray values of filled points in the same route read by every route of photoelectric sensor with the same filled scope and same darkness degree. The gray value of every route is generally consistent to the same filled points in the normal OMR. The error is no more than ± 1, so it is nearly a beeline in the consistency curve.

"Line": the total number of the synchronous frames according to the filled points of the forms, which are ready to be read.

"Syncs": the synchronous frames number of the forms.

As the following Picture 5.9, it is the consistency of the 60_{th} row filled points. From the picture, we can know that the consistency of this photoelectric sensor is good.



Picture 5.9

7. Wave Analysis

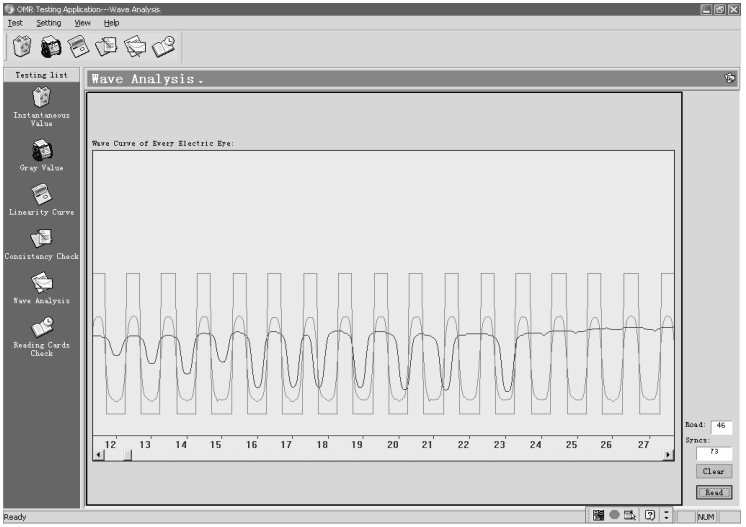
Wave Analysis refers to the curve graph about instantaneous valued collected by the Synchronous route and a certain route of photoelectric sensor. (As Picture 5.10)

You can analyze the work estate of the photoelectric sensor by observing its wave curve. And check the installing position of the photoelectric sensor according to the corresponding of the filling signals and the rim signal curves.

The original rim curve gained by reading the proportional synchronous frames is nearly to sinusoid. The square wave curve is the standard rim curve transformed from the original rim curve. The darker curve is the signal curve collected by a certain route. You had better adopt the Wave Curve collected by the upper photoelectric sensor routes (such as route46), when you want to check the transverse position of photoelectric sensor. If the photoelectric sensor is in the right position, the filled points' impulse locates at the center of the standard rim curve. (except for the track18 to track21 of standard test forms). If the filled points' impulse locates leftward, it indicates that the photoelectric sensor is

too rightward. It should be adjusted to leftward. On the contrary, it should be adjusted to rightward.

Picture 5.10 appears the Wave Curve of 46 route photoelectric sensor. In order to test the excursion of photoelectric sensor, we set simulate excursive filled points in 18 route to 21 route in standard test forms in order to check the excursion of the photoelectric sensor. From the following picture, we can know that the impulse and the excursion of the standard rim. As for the filled points of 16 route and 17 route in the right position, the points' impulse of signal curve locates mostly in the center of standard rim curve, then it indicates that the photoelectric sensor has no transverse excursion.



Picture 5.10

8. Reading Check

Reading Check is used to test the function of the whole OMR. The main principle is to check whether the OMR has mistakes in reading information areas. And then you could make a further

adjustment to OMR according to the fact.

The process of reading forms is mainly like the following:

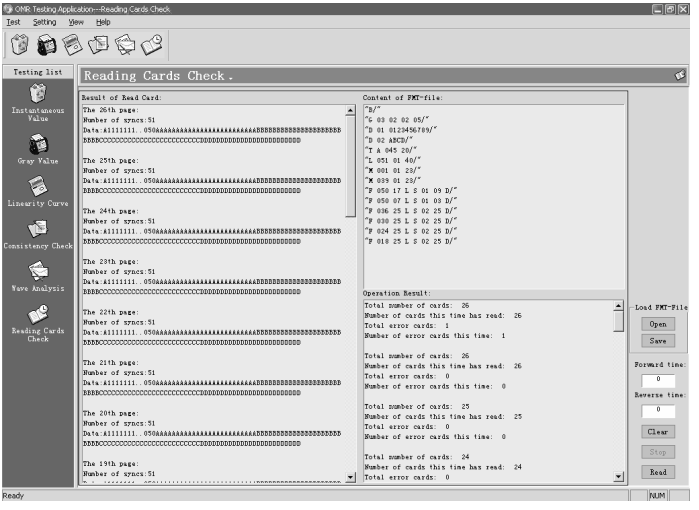
① Edit the format files of the forms in the form of plain text, which has ".txt" as the postfix.

② Click the button "Open" to open the format files you have saved, then the format files content that you hope to load appears in the display district of "Content of FMT-file".

③ Click the button "Save" to load this format file onto the storage district of OMR.

④ Put the forms into the input stacker, and click the button "Read", then the OMR will start to work.

The character strings information of forms will display in the display district "Result of Read Card"; the reading statistical information displays in the display district "Operation Result". As the following Picture 5.11:



Picture 5.11

NOTICE: The hardware fixing, linearity curve test, gray value test, instantaneous value test and feeding adjustment have been set well

before leaving the factory. The machine can work normally. So the arbitrary change is not recommended.

Chapter Ⅵ Maintenance

6.1 Daily Maintenance

(1) Far from shock, moisture and dust in transportation and storage.

(2) The working conditions of OMR should be good enough. There should be stable power, suitable temperature and humidity. Keep clean.

(3) Avoid being illuminated by sunshine while the machine is working, it should be covered well.

(4) OMR machine has some certain demands to forms' material, printing and cutting. It's better to choose forms from professional factory. If the OMR with pen read head, the ground color of forms cannot be yellow, green and blue. Only red ground color can be read.

(5) Keep forms clean and neat, not be folded and not be crumpled. Otherwise, something on forms will damage the delivery wheels, form trail and photoelectric sensor.

(6) To make sure the reading successfully and exactly, the mark tool should be 2B pencil. Make sure that: "exact", "dark", "full", "symmetrical", "clean".

"Exact": It should be exact when fill the information bit. Don't fill the wrong position especially the examination number.

"Dark": The marks color should be dark.

"Full": The pane of information bit should be full filled.

"Symmetrical": All marks color on one form should be similar.

"Clean": Keep the form clean. If there is fault, erase it with eraser.

(7) The machine should be cleaned Periodically, especially the

delivery wheels, form trail and sensor. As for how to pick off the photoelectric sensor, please refer to the following picture 6.1:

NOTICE:
Loosen the screw in middle will be ok.
Don't loosen the screws on both sides if not adjust the position of photoelectric sensor.

Picture 6.1 Pick off the photoelectric sensor

6.2 Malfunctions and Treatment

1. Power trouble

Power trouble include two conditions: one is no output voltage, and the other is abnormal voltage or large wave. No output could cause the trouble that the machine doesn't work. The abnormal output could cause troubles like these: the wheels doesn't work or run all the time, instantaneous value turns large, sync error, detecting dots and line error, multi-sheet error, multi-mark or leak-mark error and so on. In this case, you should check:

① If the power is properly supplied AC 220V or 110V and if it is well connected.

② If the cables of OMR and insurance pipe are in good conditions; the insurance pipes are in the power socket behind the machine base. The type of insurance pipe is 2A. Please refer to the picture 6.2.

Picture 6.2 Power socket and insurance pipe

③ If the lead wire and connecting components related to the power are well connected. If not, please connect again or solder them well. Please connect the earth properly. (refer to chapter III, 3.1.3)

④ If the switch power is normal. If it's damaged or in bad performance, you need find professional people to mend or change it.

2. Offline

① Communication plug is not well connected, shut off the power, and then reconnect it.

② The serial cable is open circuit or short circuit. You can measure it with multimeter, connect the two points of the cable with the order "2-3", "3-2", "5-5". If not properly, please change it.

③ The serial interface (or USB interface) is damaged. Please mend the computer or change the computer with normal serial interface (or USB interface)

3. Wheels don't work

① The pulley strap is broken or dropped. Please open the bottom

cover and hook it well referring to the following picture.

Picture 6.3 Pulley strap

② Pulley's screws on the top are loose. Please screw them tightly.

③ The wire of the machine is not well connected or there is something wrong with the motor. Press "STEP" on operating panel and don't loosen, the motor should run. Otherwise, you should check the motor wire or motor.

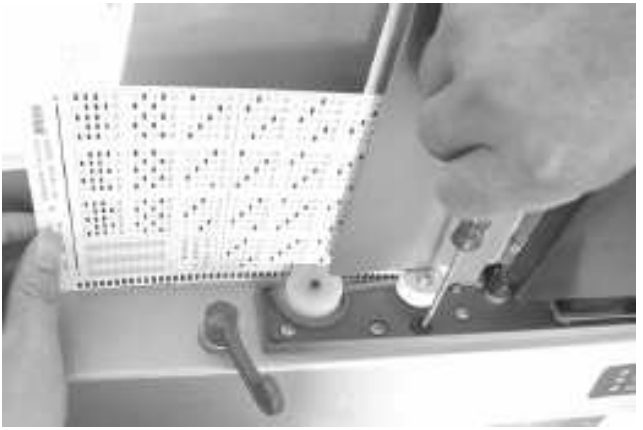
④ The control part of the motor is damaged. It needs professional person to mend.

4. Feeding sheet is not smooth.

① The forms are not even or are folded. You should feed forms after make them even.

② There is wastepaper or something abnormal in paper tracks. Please clear the paper tracks. (refer to 6.1.7 of this chapter)

③ The gap of multi-sheet part is too narrow. It should be one-sheet thickness. Please refer to the picture 6.4.



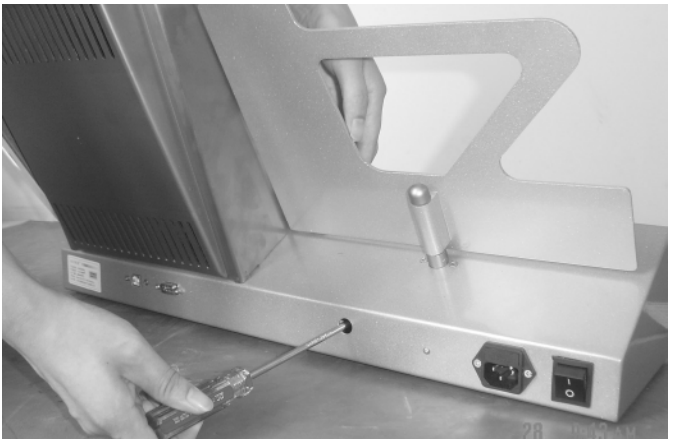
Picture 6.4 Adjust the gap of multi-sheet part

④ The feeding wheel doesn't work or the pressure of the turning arm is too small. Please refer to 2.3 of this chapter to deal with the feeding wheel. If the pressure of turning arm is small, you can loosen the screw of it, and then you can see a spring, insert it into the hole of larger twist strength. Don't make the screw too tight. Otherwise, the turning arm cannot turn freely. Please refer to the picture 6.5.

Picture 6.5 Adjust the pressure of turning arm

⑤ Too many forms are put on the input stacker or the thrust of

the input stacker is not big enough. It is better not over 120 sheets in size of 21*29.7cm. If the thrust of the input stacker are small, adjust the “screw of the input stacker” clockwise. Please refer to the picture 6.6.



Picture 6.6 Adjust the thrust of the bracing board

⑥ The frame number of “L” command in format file is too big. (Please refer to chapter IV, 4.3.2)

⑦ Rubbing time is too short. If feed forms not smoothly when read big forms (such as the form in the size of 18.4*26cm), you can increase the time modulus of rub forms. (refer to the chapter V, 5.3.2)

⑧ Haven’t demarcated when change larger sheets. Demarcate it according to chapter V, 5.3.2.

5. Synchronous sign error

① The printing of form’s synchronous frame is not good. The black frame is too light or there are big white dots and maybe there are something dirty on it. You should black the black frame with 2B pencil.

② The choice of format files is wrong or dot matrix definition is

wrong. Correct the format files.

③ The synchronous route's "electric eye" is abnormal. Please refer to Chapter V, 5.3.3 to observe the instantaneous value of synchronous route. Put a piece of form under the photoelectric sensor; turn the front rubbing wheel to move the paper. When the synchronous route's "electric eye" faces the white frame, the instantaneous value is the largest. It ought to over 60(H). When faces the black frame, it ought to be the smallest (about one third of the largest). If the transient value is not right, please check the related parts of the synchronous route and change or adjust it.

6. Double-sheet error

① It is easy to appear double sheet when the forms are affected with damp or static. Before reading, clap the forms with hand to drive the damp and static away. The storage of forms must avoid damp or electrostatic.

② The gap of sheets disparting part is too large. Adjust "multi-sheet gap adjusting screw" to make the gap one-sheet thickness. (refer to the picture 2.2 and picture 6.4)

③ Input stacker thrust is too large. Adjust the "input stacker thrust adjusting screw" clockwise behind the machine body base. (refer to the picture 6.6)

④ The gap between input stacker and rubbing wheel is too narrow. You can loosen the "input stacker fixing screw" and adjust the gap bigger. (Refer to the following picture 6.7)

Picture 6.7 Input stacker and fixing screw

⑤ The frame number of “L” command sign in format files is too small. (refer to Chapter IV, 4.3.2)

⑥ The reversal number is too small. Please refer to Chapter V, 5.3.2 to increase the modulus of reversal time.

7. Distort to be double-sheet error

① If forms are folded or there is dirt at the blank area up synchronous frame, it may distort multi-sheet error. Unfold the forms and clear the dirt and read again.

② The thickness difference of forms is too large. When read very thick forms, there may be double-sheet error notification. The thickness of forms should be even. Please use forms of the same thickness in once reading.

③ The instantaneous value of double-sheet route is too low. Change a form being read to check the double-sheet route instantaneous value, put it under the photoelectric sensor and the instantaneous value of double-sheet route ought to over 60 (H). If the instantaneous value of double-sheet route is too low, please adjust the POT of D route and demarcate the feeding mode. Refer to Chapter V,

5.3.2 and picture 6.8.

Picture 6.8 Adjust resistance of D route

8. Detecting dots and line error

① The printing of detecting dots and line is not good. You can black it with pencil and then read again.

② Feeding sheet is not smooth. Place the sheets well and read again.

③ "Electric eye" of some route is abnormal. You can check the routes with "consistency" function of test software (refer to Chapter V, 5.3.6). If the value of some route is low, please check if the parts of routes are damaged. Demarcate according to Chapter V, 5.3.2 after mending again.

④ Format files are compiled or chosen wrongly. Please check that if the detecting dots and line definition command "M * * * yy

YY/”is consistent with the forms being read (please refer to Chapter IV,4.3.3). If there is error, correct and read again.

9. Format sign error

① Format sign is not filled in. Fill it and read again. If there is only one exam paper type, format signs could not be filled in, and then you can define the format sign onto the detecting dots and line in format files. E.g. the form of 105 problems, you can change the format sign definition command “T A 046 19/” to “T A 039 19/”. (Refer to Chapter IV, 4.4,format files)

② It distorts format sign error if the synchronous sign is wrongly read. Deal with it according to this Chapter, 6.2.5.

③ Format files are chosen incorrectly or format sign definition command is not correct. Please check if the format sign definition command is consistent with the forms being read. (Refer to Chapter IV, 4.3.1)

④ The “electric eye” according to the format sign is abnormal. Deal with it according to this Chapter 8.③.

10. Multi check

OMR machine reading out the marks that are not filled in is called multi check.

① Forms are wrongly filled in or dirty or doesn’t wipe up. Wipe up or copy a new one with the clean form and read again.

② The background color of the form that the pen read head OMR read must be red, if use blue, green or yellow it will appear multi check. You should change the form with red background color or change a pencil read head machine.

③ The consistency of some routes is high. Please check the consistency and demarcate again. (Refer to ChapterV, 5.3.2)

④ The static could cause multi check. The air is too dry, the continuous reading time is too long will cause the static. You can

increase the humidity of the air and leave the machine a rest. Wipe the machine up and clear the paper track to prevent static. Please note that connect the earth wire well.

⑤ The setting of "NN" in gray degree adjusting commands of format files "G MM NN mm nn/" is low. This command is generally "G 03 02 02 05/". If the multi checks are too many, you can change it to "G 03 03 02 05/". (Refer to Chapter IV, 4.2.6)

11. Missing marks

That OMR machine doesn't read out the filled marks is called missing marks.

① The marking tool is chosen wrongly or the filling color is too light. It should use 2B pencil or carbon pen to fill if the machine is pencil read head and make sure that: "exact", "dark", "full", "symmetrical", "clean".

② Feeding cards is not smooth. Please put the forms well and read again.

③ The consistency of some routes is low. It generally warns detecting dots and line error. Please deal with it refer to this Chapter 2.8.③.

④ The marks gray degree setting in format files is too high. If you set it as "G03 03 02 05/", it will appear lots of missing marks. Please set it as "G 03 02 02 05/" by the book.

12. Command parameter error

The reason for this error is that the files compiling is wrong. There are commands that the OMR machine couldn't identify. E.g. there is no ending sign "/" after the command row; no space bar among parameters; the digits number of parameter are not enough or beyond the regulate scope. Please refer to Chapter IV and check the format files carefully. Correct the error and read again.

13. No format

① No format files. Format files in computer have been deleted or changed name. Input the right format file names or compile the format files again.

② If the electricity is cut off suddenly when reading forms, the computer will not transmit the files to OMR machine. You should boot the format files once again and read.

Chapter VII Appendix

7.1 Machine stop notification

01: No format;
02: Data overflow (Photoelectric Sensor A);
03: Double sheet error;
04: Format sign error (Photoelectric Sensor A);
05: Detecting dots and line error (Photoelectric Sensor A);
06: Command parameter error;
07: Paperboard or synchronous signal error (Photoelectric Sensor A);
08: Offline;
09: Synchronous route's counting number out of range (Photoelectric Sensor A);
11: A and B matching error;
12: Data overflow (Photoelectric Sensor B);
13: Format sign error (Photoelectric Sensor B);
14: Unknown error;
15: Detecting dots and line error (Photoelectric Sensor B);
16: No sheet;
17: Paperboard or synchronous signal error (Photoelectric Sensor B);
18: Communication error;
19: Synchronous route's counting number out of range (Photoelectric Sensor B)

7.2 Code definition of reading output

The table of BCD code transform

Output	Filling	Output	Filling
0	• • • •	8	8 • • •
1	• • • 1	9	8 • • 1
2	• • 2 •	0	8 • 2 •
3	• • 2 1	>	8 • 2 1
4	• 4 • •	>	8 4 • •
5	• 4 • 1	>	8 4 • 1
6	• 4 2 •	>	8 4 2 •
7	• 4 2 1	>	8 4 2 1

The output codes of NHOMR (“+1/”)

Output	Filling	Output	Filling
A	{A }	Q	{A E}
B	{ B }	R	{ B E}
C	{ C }	S	{A B E}
D	{ D }	T	{ C E}
E	{ E}	U	{A C E}
F	{ B C }	V	{ B C E}
G	{A B C }	W	{A B C E}
H	{A B }	X	{ D E}
I	{A D }	Y	{A D E}
J	{ B D }	Z	{ B D E}
K	{A B D }	[	{A B D E}
L	{ C D }	\	{ C D E}
M	{A C D }	]	{A C D E}
N	{ B C D }	∧	{ B C D E}
O	{A B C D }	—	{A B C D E}
P	{A C }	•	{ }

The output codes of GB (“+2/”)

Output	Filling	Output	Filling
A	{A }	I	{ B D}
B	{ B }	J	{ C D}
C	{ C }	K	{A B C }
D	{ D}	L	{A B D}
E	{A B }	M	{A C D}
F	{A C }	N	{ B C D}
G	{A D}	O	{A B C D}
H	{ B C }	P	{ }

The output codes of DRS (“+3/”)

Output	Filling	Output	Filling
A	{A }	I	{A D}
B	{ B }	J	{ B D}
C	{A B }	K	{A B D}
D	{ C }	L	{ C D}
E	{A C }	M	{A C D}
F	{ B C }	N	{ B C D}
G	{A B C }	O	{A B C D}
H	{ D}	*	{ }

7.3 OMR Driver program interface

The list of the interface function

The function antetype	The function
int _stdcall OmrInit(int nPort)	Turn on the connection of OMR and PC, and startup OMR
int _stdcall OmrS(char *buf)	Deliver commands and data from PC to OMR
int _stdcall OmrG(char *buf)	Receiving data from OMR
int _stdcall OmrClose()	Turn off OMR, cut off the connection of OMR and PC
int _stdcall OmrGetError(char* err)	Obtain the current error code
int _stdcall OmrGetErrorStr(char* err)	Obtain the current error character string
int _stdcall OmrSetTest(int syncNum，int num)	Put OMR in the testing state
int _stdcall OmrGetValue(char type，int* bufInt)	Obtain the wanted Instantaneous Value
int _stdcall OmrGetOriOrGray(char type，int* bufInt)	Obtain the wanted Gray Value
int _stdcall OmrGetCurve(char type, int* bufInt)	Obtain all the value of the points on the curve

The detailed explanation of application

1. The transfer of DLL

DLL should be adopted in the form of obvious mode link. Programmer can check relevant help files to operate the link, according to the differences between the programming languages and programming tools.

2. int _stdcall OmrInit (int nPort)：

The function is used to turn on the connection (standard COM)

between OMR and PC, and send online command to start OMR.

Backtracking value: The function backtracks an integer value to show the operating result. When the work above is completed successfully, the backtracking value will be a positive integer; On the contrary, the backtracking value will be zero or negative integer. At the meantime, you should check if the connection of hardware is normal and do this operation over again.

Parameter: The function needs an integer parameter to express the COM port No..（The demonstration is as follows:）

```
//define the function pointer
typedef int _stdcall OmrInit ( int nPort );
typedef int _stdcall OmrClose( );

//define variables
HINSTANCE m_hDll;              //the Dll's handle
OmrInit OpenOmr;
OmrClose CloseOmr;

m_hDll=::LoadLibrary(str);
if(m_hDll!=NULL) {
    //get the function named "OmrInit" and "OmrClose"
    OpenOmr=(OmrInit)GetProcAddress(m_hDll, "OmrInit");
    CloseOmr=(OmrClose)GetProcAddress(m_hDll," OmrClose");
    if(OpenOmr!=NULL && CloseOmr!=NULL) {
        if(OpenOmr(1)>0) {
            AfxMessageBox("Connected with
                                OmrSuccessfully!" );
            //do something;
            CloseOmr();   //after finished all tasks,close the omr
        }
    }
}
```

3. “OmrS” and “OmrG”

The two parameters have the same backtracking value and parameter list. The former is used to send commands to OMR, while the latter is used to receive the data backtracked from OMR. “OmrS” and “OmrG” are the most common parameters, which complete the principal communication function with OMR.

What should be paid more attention is the two functions’ parameter “buf”, which is a variable of character string. In the using process, first, you need to distribute “buf” enough length to hold the data you want to send or receive. On the contrary, there will be the result of data overflow.

The backtracking value of “OmrS” is also very important. It indicates your command has been carried out by OMR correctly, when the value is in the form of positive integer. Next you can go on with other works. If the backtracking value is a non-positive integer ($\leqslant 0$), it indicates that there must be some mistakes in the process of OMR work. Then you need to transfer the function “OmrG” to obtain the wrong information (one or two Bytes code commonly), and go on with other commands.

The backtracking value of “OmrG” refers to the length of character string data obtained from OMR. You can judge if it is the same with the length your anticipation.

There is the demonstration as follows:

```
char command[30];      //the command string is stored in here
char result[500];      //to get a string and its length is less than
                       500 bytes
strcpy(command, "R/");     //the command string is "R/"
int ref=OmrS(command);
if(ref>0) {
     strcpy(command, "r A 0001 0500"); //now the command
          string changed
     ref=OmrS(command);
     if(ref>0)
        OmrG(result);     //get the result;
  }
  else
     OmrG(result);     //get the error code occurred during
                         reading cards
```

In the above, there are two variables defined. "Command" is used to save the character string command that is to be sent; "Result" is used to save the received character string data. They both are defined in enough length. First, send the command "R/" to read forms, if no other error, then send the command "r A 0001 0500" to read the data including at most 500 bytes. If there are some errors, you can transfer "OmrG" to receive the wrong codes directly.

Remark: The wrong code refers to the character strings with 2 bytes in the scope from 01~20. You can check the corresponding character strings by looking into the list of corresponding error.

4. OmrGetError and OmrGetErrorStr

If the OMR discover the error when run the commands. The two functions will gain the error information instead of "OmrG". "OmrGetError" is used to obtain the error code and "OmrGetErrorStr" is used to obtain the wrong character string that accord to the error code.

As follows:

```
//if an error occurred
Char error[100];       //store the error string;
OmrGetError(error);     //the "error" is "01" to "20"
OmrGetErrorStr(error);   //now the "error" is a string like "Double sheets"
```

5. OmrSetTest, OmrGetValue, OmrGetOriOrGray, OmrGetCurve

These four functions are used under the condition of the OMR test. "OmrSetTest" is used to make the OMR machine under the test condition. Only after running this function successfully, the other three functions can be run.

The two parameters of function "OmrSetTest" mean the total number of synchronous frames and routes. If the OMR was set the test condition successfully, the backtracking value should be positive integer. Otherwise, the backtracking value is non-positive number.

The three functions left have the same parameters "type" and "bufInt". The value of "type" is 'A' or 'B'. When there is only one photoelectric sensor, the value should be set 'A'. Please note that this parameter ought to be form of character but not character string. "bufInt" is used to store data. You should also distribute enough length to it. Just as follows:

```
Char command[30];
Int *bufferInt=NULL;              //store the data got from OMR
Int ref=OmrSetTest(73,46);
If(ref<0)
   AfxMessageBox("Fail to set OMR to the testing state");
Else {
     Strcpy(command, "I 4/");      //the command is to get the
                                   instantaneous value
     Ref=OmrS(command);            //send the command to OMR
     If(ref>0) {
        bufInt=new int[64];        //the largest amount of instantaneour
                                   value is 64
        OmrGetValue('A',bufInt);
```

```
        //do something……
        Delete[] bufInt;
        bufInt=NULL;
    }
    Strcpy(command, "I 2 001 01 010 10/");   //the command is to get the
                                             gray value
    Ref=OmrS(command);
    If(ref>0) {
          bufInt=new int[10*10];
          OmrGetOriOrGray('A',bufInt);
          //do something……
      }
}
```

THE END!

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