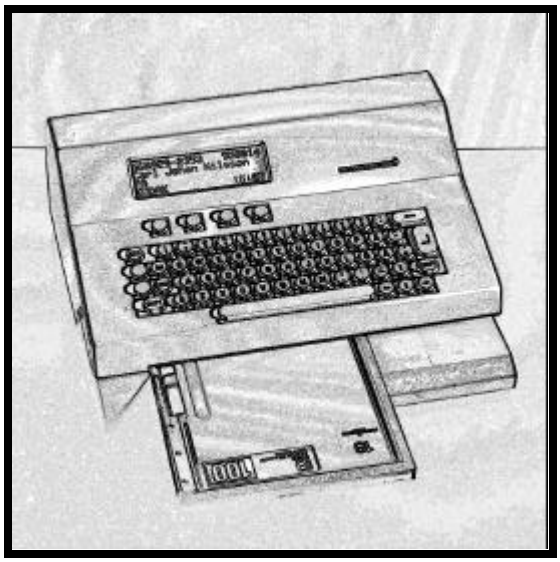
Network Installation Manual

Publication No XP 3478
4/99
Supersedes 7/97



KODAK
Network ID Camera

Health Imaging

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1 Data Download

1.1 Patient data

1.1.1 General

The Kodak Network ID camera is able to receive patient data from a patient booking system. This can be achieved in two ways depending on how the booking system works.

1.1.2 Direct mode.

This mode is used when each camera can be connected to its own terminal of the booking system. When a patient arrives to the examination room and that is registered at the terminal of the booking system the booking system immediately sends the patient data to the camera which immediately displays it. This means that no user interaction is necessary on the camera to make the camera ready for marking.

1.1.3 Download mode.

This mode is used when all cameras are connected to the central computer of the booking system through one serial channel or if there are no terminals in each room. In download mode a complete patient list is sent to each camera and operator has to bring up this list on the camera to select the patient when the patient arrives at the examination room. In this case all cameras are connected in parallel to one serial channel on the host computer.

Except for patient data, time and date of the booking is also sent which the KODAK Network ID Camera uses to sort the booking list. When the user brings up the booking list the patient nearest in time is pointed out. This means that the user only needs a few keystrokes to select the patient. To allow a camera to only store patients intended for a specific room each patient data record is associated with a camera name and the camera may reject all patients not intended for a specific room. Note that it is possible for more then one camera to have the same name for example if there are many rooms that do the same examination and the patients are taken to the room that gets available first. Patients can be sent to the booking list at any time and any number of times. Duplicates are thrown away and when the booking list becomes full the patient with the oldest booking time is removed from the list.

1.1.4 Physical connection.

There are two ways to physically connect the camera to a booking system. Any of the connections can be used with any of the protocols above. Just remember that if the direct protocol is used cameras can not be connected in parallel as they would in that case bring up the same patient at the same time and that is not very functional.

One is through a RS232 interface. This is the normal way to use when using the direct mode as one camera is connected to one host computer. Note that communication is one-directional, from the host to the camera, which means that it is possible to connect more then one camera to one host using RS232 but as the driving capacity of RS232 is limited, which affects both maximum cable length and number of cameras, this is not recommend.

The other is through a RS422 interface. This is the normal way to use when using the download mode. It allows longer cables (up to hundreds of meters depending on which sender is used) and it allows may cameras to be connected in parallel. It can of cause also be used with the direct protocol for example if the cable distance is too long for RS232.

1.2 X-ray data

1.2.1 General

The Kodak Network ID Camera is able to receive and exposure data, like kV and mAs, from a X-ray unit. When the X-ray unit make a exposure, exposure data is sent to the Kodak Network ID Camera and when the film later is marked by Kodak Network ID Camera the exposure data is printed on the film together with patient data.

Kodak Network ID Camera can be connected as usual to a booking system for downloading patient data. One camera is needed for each X-ray unit.

The sequence of operation is that when the patient arrives for the research patient data is entered into the camera the usual way (manually or through booking system). After an exposure is made the exposure data is immediately sent from the X-ray unit to KODAK Network ID Camera. The cassette should immediately after the exposure be brought to the camera and marked. The camera only stores data from the latest exposure. If KODAK Network ID Camera would store data from many exposures to allow many cassettes to be marked afterwards there is a big risk of exchanging cassettes so there are many reason to force an immediate marking. To prevent a cassette to be marked when there is no exposure data KODAK Network ID Camera can be configured to not allow marking if exposure data is not available. When a marking is made the exposure data is immediately erased to prevent two cassettes to be marked with the same data by mistake.

1.2.2 Physical connection

Kodak Network ID Camera can receive X-ray data through a RS232 interface. Most X-ray units are, or can be, equipped with a printer interface and through this Kodak Network ID Camera can be connected instead of a printer.

2 The Protocols

2.1 Patient data

2.1.1 General

Four protocols are available. Two protocols were created for the Kodak Network ID Camera with the intention of giving a flexible protocol which can handle language dependent information and can transfer more data then just the name and patient ID. Two other protocols were implemented to be compatible with the KODAK X-OMATIC Identification Camera Model 2010 that was sold in the Nordic countries between 1990 and 1993. We do not recommend that new software are written for these protocols.

The protocols are in the camera called;

DIRECT	The KODAK Network ID Camera direct mode protocol
DOWNL	The KODAK Network ID Camera download protocol
2010 B	A protocol compatible with the KODAK X-OMATIC Identification Camera Model 2010 used when the camera is connected to a transmitter box called MNT10.
2010 D	A protocol compatible with the KODAK X-OMATIC Identification Camera Model 2010 used when the camera is connected without the MNT10.

All protocols accept national characters according to ISO8859-1 standard, please refer to appendix A.

2.1.2 KODAK Network ID Camera Download protocol

The protocol:

#group;date;time;fieldlist#CR,LF

Group	is the name of the lab where the camera(s) are located. This may be used to select which camera(s) should store which patients. If this field is left blank (the trailing ; must be included) the camera will accept the patient data regardless of the name of the camera. This can be used as a broadcast to all cameras.
Date	is the booked date for the research. Date format is YYMMDD or DDMMYY depending on which country the camera is configured for. The same format is used as when displaying the date information in the main window of the camera.

Time is the booked time for the research. Time format is HHMM. The date and time information is used to sort the list and to be able to point out ”best guess” when opening the window with the list of patients.

Field list This is described below as it is the same format as for direct communication. At least one name field must be included in the field list and for countries using patient ID a patient ID field must also be included. See **field list specification** below for more details

CR,LF These two characters terminates the block. To make the protocol as compatible as possible the camera will accept, CR only, LF only and any sequence of CR and LF.

Trailing and leading spaces in all fields in the field list are removed so if the programming language used for the sender software has problems sending variable length text strings (as some COBOL dialects do), just pad with spaces and the camera will remove them. Just make sure that the total length including leading and trailing ‘#’ does not exceed 128 characters.

2.1.3 Direct protocol

This protocol is used when one camera is connected to one terminal. When the patient data is sent from the computer the patient data window is immediately opened with the data transferred.

#window;field list#CR,LF

Window is a single digit telling which cassette window should be used. Currently two are defined. ‘1’ is the standard C1 window, ‘2’ is the narrow C1N window. If ‘*’ is used instead of a digit the window currently selected by the operator is used.

Field list This is described below as it is the same format as for download communication.

CR,LF These two characters terminates the block. To make the protocol as compatible as possible the camera will accept, CR only, LF only and any sequence of CR and LF.

The following string may be sent to the camera to close the window when the examination has finished.

#QUIT#CR, LF

Trailing and leading spaces in the patient ID and name fields and fields in the field list are removed so if your program has problems sending variable length text strings (as some COBOL dialects do), just pad with spaces and the camera will remove them. Just make sure that the total length including leading and trailing ‘#’ does not exceed 128 characters.

2.1.4 Field List

The field list contains the information that will be displayed in the different fields of the window.

The field is in the following format:

nr:text

nr is the two-digit field number, text is any text that fits into the field. If the field is too long the camera will just truncat the text to make it fit. If more then one field should be transferred more fields can be transferred by separating them with ';'.

There are also three special fields used by the download protocol:

I:PID
N:name
Nn:name

PID is the patient ID of the patient. It should be in the format defined in the country where the camera is used. If the patient ID is invalid it will be displayed as a spare patient ID (underlined) number when appearing on the display. The patient ID field is mandatory for countries using patient ID when using the download protocol.

Name is the name of the patient. This field is always mandatory when using the download protocol.

In the Nn: field 'n' represents a number from 1 to 9. This is used if more then one name field is defined in the window. When the patient name is displayed in the booking list of the camera all Nn fields are merged together with a comma in between. The N1 field will be displayed in the first name field of the window, N2 in the second and so on.

The field number here is not the field number presented in the left column of the exposure window set-up. Instead there is a translation table setting the correspondence between the field number in the message and the field number of the exposure window. This is because we want the user be able to change the configuration of the camera without having to change the program in the host computer.

From the programmers point of view, he or she can select numbers sequentially from 0 and upwards for his information and the person who configures the camera then sets where that data will be displayed. This way the programmer must not know how the camera is configured. If there is no information for a field it can be completely omitted. It is legal to send information for field 1 and 3 for one patient and 1 and 2 for some other patient. Just watch out so that the total length of the protocol is not longer then 128 characters.

As a feature to make it easier to send data from programs through a printer driver which is page oriented CR/LF is allowed before any semicolon. This way it is possible to send data from a MS-WINDOWS® program by defining a printer of type generic and design a report with fields put on different lines and then send the data to the camera by printing such a report.

2.1.5 Protocols compatible with the KODAK X-OMATIC Identification Camera, Model 2010

Because of compatibility reasons the protocol of the KODAK X-OMATIC Identification Camera Model 2010 is also included in the Kodak Network ID Camera. KODAK X-OMATIC Identification Camera, Model 2010 was sold in the Nordic countries between 1990 and 1993. We strongly recommend that no new software is written for any of these protocol.

Two versions of this protocol are available.

2010 B — A protocol compatible with the KODAK X-OMATIC Identification Camera Model 2010 used when the camera is connected to a transmitter box called MNT10.
This protocol includes the STX, ”2” and ETX characters of the description below.

2010 D — A protocol compatible with the KODAK X-OMATIC Identification Camera Model 2010 used when the camera is connected without MNT10.
This protocol excludes the STX, ”2” and ETX characters of the description below

If a field contains more characters then needed, the field should be padded with spaces.

National characters like ÅÄÖ can be sent either as 7-bit ANSI code or as 8 bit ISO 8859-1 or the codepage 850 code which DOS uses. Please refer to appendix A.

2010 B	2010 D			
0		STX	0x02	Start of text
1		‘2’	0x32	Source, always ‘2’
2 .. 7	0 .. 5			Address
8	6	‘ ‘	0x20	Separator
9, 10	7, 8	DD		Booked date, Day, (for Sweden year)
11, 12	9, 10	MM		Booked date, Month
13,14	11, 12	YY		Booked date, Year, (for Sweden day)
15	13	‘ ‘	0x20	Separator
16, 17	14, 15	HH		Booked date, Hour
18, 19	16, 17	MM		Booked date, Minute
20	18	‘ ‘	0x20	Separator
21 .. 60	19 .. 58			Name, 40 characters
61	59	‘ ‘	0x20	Separator
62 .. 72	60 .. 70			Patient ID (11 to 14 char, no check)
73	71	CR	0x0d	Carriage return
74	72	LF	0x0a	Linefeed
75		ETX	0x03	End of text

2.1.6 Examples

Below follow some examples of all of the protocols.

2.1.6.1 Example download protocol

Let’s say that you like to send the patient ID ”950822-1234” the patient name ”Eric Johnsson” and one line of text ”Broken leg” to the camera and any window should be used. The following string should be sent to the camera.

#LAB1;960824;1200;I:950822-1234;N:Erik Johnsson;1:Broken leg#CR,LF

In next example a patient ID and data for two name fields are sent and also text for two other fields.

#LAB1:960824;1215;I:950822-1234;N1:Eric;N2:Johnsson;1:150 ml contrast;2:Cardio#CR,LF

2.1.6.2 Example direct protrcol

Let’s say that you like to send the patient ID ”950822-1234” the patient "Eric Johnsson” and one line of free text ”Broken leg” to the camera and any window should be used. The following string should be sent to the camera.

#*;01:950822-1234;02:Eric Johnsson;03:Broken leg#CR,LF

2.1.6.3 Example of protocol compatible with the KODAK X-OMATIC IDENTIFICATION CAMERA, MODEL 2010

In the 2010 camera the field lengths, and hence the record length, are fixed and to show this the period character is used to show the space character below:

STX
2
LAB1...960824.1215
Eric Johnsson.....
950822-1234
CR
LF
ETX

2.2 X-ray data

2.2.1 General

Kodak Network ID Camera has three built in software selectable communication protocol for receiving X-ray data.

MMAT3000 - Receiving data from Siemens Mammomat® 3000.
SENOGRAPH - Receiving data from GE Medical System Senographe.
GXDP - Is a General X-ray Data Protocol.

2.2.2 MMAT3000

Twelve different exposure data are sent from the Mammomat® and each and one of them can be individually placed on the picture, more about that below. The following data's are available.

Data	Value	Length
Focus	SF/LF*	2
Anode	W/Mo*	2
Filter	Rh/Mo*	2
kV	0 to 99kV	2
mAs	0 to 999 mAs	3
Exp.time	0 to 99999 ms	5
Magnification	0.00 to 9.99	4
Force	0 to 99 Kg	2
Thickness	0 to 999 mm	3
Grid	No grid/Grid*	7
Density	-9.9 to +9.9	4
Angle	-180 to +180 degree	4

* The texts displayed here may be changed in KODAK Network ID Camera. The data is sent as 0 or 1 from the Mammomat® and translated by KODAK Network ID Camera to the appropriate texts.

2.2.2.1 Configuration of Kodak Network ID Camera

Configuration of KODAK Network ID Camera for connection with the Mammomat® can be divided into two parts. One is to configure the serial channel for communication with the Mammomat®, the other is to create the picture that will be printed on the film.

The Mammomat® is connected to the AUX connector at the back of the KODAK Network ID Camera. The communication is set-up by entering set-up mode of the camera, please refer to the Installation and Setup Manual. When in the communication set-up, press the F1 key so that the word "Channel: AUX" is displayed in the upper rigth corner. The set-up should now be set to:

Baudrate	9600
Parity	NONE
Databits	8

Protocol MMAT3000

As mentioned above when the different data available is shown the texts for a few items can be changed (those marked with *). This is done by opening a new set-up window by pressing Shift-F1 from this set-up window.

Creating the picture which will be printed on the film is done in the same way as usual except that there is one extra field type available. The COMM field type. When such a field is selected and enter is pressed an extra selection appears in the window called COMM: were you select which kind of exposure data should be displayed in the field. To build a picture you will have to define one COMM field for each exposure data to display. Note that the field data do not include the unit (kV mAs and so on). To add that an F-text field with the appropriate text has to be inserted after the COMM field.

2.2.2.2 The Mammomat®

DISCLAIMER: The information in this chapter is given to us by Siemens Elema in Stockholm and neither Triacon or Kodak can guarantee the correctness of the information.

The exposure data connection works with Mammomat® 3000 equipped with software version 1.6 or later. Also the hardware must be up to date. Serial numbers starting at 2486 and later are up to date. Siemens Elema estimates that equipment fulfilling these requirements are delivered from spring 1996. Earlier versions of the Mammomat® 3000 may be updated both regarding hardware and software.

In addition to the requirements above the Mammomat® must also be equipped with a printer interface. The installation kit for the printer interface includes a printer cable and below follows a description on how to make an adapter between this cable and KODAK Network ID Camera. Since the printer cable is standard with the printer interface we recommend using this cable and adding an adapter rather than making a completely new cable.

If the correct Mammomat® software and hardware are installed the Mammomat® will automatically configure it self for use with the KODAK Network ID Camera when the KODAK Network ID Camera is connected.

2.2.2.3 The KODAK Network ID Camera.

If the Mammomat® is ready you will only need a standard equipped KODAK Network ID Camera and a cable between the Mammomat® and KODAK Network ID Camera to get it to work.

2.2.2.4 Post-installation test.

After installation the configuration should be carefully tested. For all parameters which presents values from a list it should be tested that all values will be presented. Remember that you are not only testing the configurartion of the camera but also that the Mammomat® is sending the correct value. For all numeric values you should make sure that the longest possible value is presented correctly (for example all five digits of the exposure time) and that the least significant digit is presented. Avoid if possible to use values like 2000. It is better to test with a value like 2318.

2.2.2.5 Cable between KODAK Network ID Camera and Mammomat® 3000

Parts

1	DSUB 25 pin female connector
1	A shielded housing to the above
1	DSUB 9 pin male connector
1	A shielded housing to the above
1	Shielded 3 wire cable

Connect the two connectors according to the following table.

25 pin female	9 pin male
2	2
3	3
7	5

2.2.3 Senographe

Fifteen different exposure data are sent from the Senographe DMR and each and one of them can be individually placed on the picture, more about that below. The following data's are available.

Data	DMR Value	Length
Mode	AOP, AEC, Manual*	6**
Sub Mode	STD, CTS, DOSE*	4**
Focal Spot	SF, LF*	2**
Track	RH, MO*	2**
Filter	RH, AL, MO*	2**
kV	From 22 to 49	2
mAs	From 1 to 600	3
Tpose (exposure)	0 to 20000ms	5
Focus	51,56,61,66	2
Magnification	By % ex 150	3
Force	0 to 20 daN	2
Thickness	0 to 999mm	3
Cell	Normal, Center Stereotix, Left Stereotix, Right Stereotix	6**
Screen/Film	Label given by console	max 7 but depends on setup of Senix
Radiological thichness	0 to 999	3

* The texts displayed here may be changed in KODAK Network ID Camera. The data is sent as 0 or 1 from the Senographe and translated by KODAK Network ID Camera to the appropriate texts and these texts can be changed from the default values.

** The length depends on the values set up. The data is sent as 0 or 1 from the Senographe and translated by KODAK Network ID Camera to the appropriate texts and these texts can be changed from the default values shown above.

2.2.3.1 Configuration of KODAK Network ID Camera.

Configuration of KODAK Network ID Camera for connection with the Senographe can be divided into two parts. One is to configure the serial channel for communication with the Senographe, the other is to create the picture that will be printed on the film.

The Senographe is connected to the AUX connector at the back of the KODAK Network ID Camera. The communication is set-up by entering set-up mode of the camera, please refer to the Installation and Setup Manual. When in the communication set-up, press the F1 key so that the word "Channel: AUX" is displayed in the upper rigth corner. The set-up should now be set to:

Baudrate	9600
Parity	Even
Databits	7
Protocol	Senograp

As mentioned above when the different data available is shown the texts for a few items can be changed (those marked with *). This is done by opening a new set-up window by pressing Shift-F1 from this set-up window.

Creating the picture that will be printed on the film is done in the same way as usual except that there is one extra field type available. The COMM field type. When such a field is selected and enter is pressed an extra selection called COMM: appears in the window were you select which kind of exposure data should be displayed in the field. To build a picture you will have to define one COMM field for each exposure data to display. Note that before you do this, the communication must be configured otherwise the KODAK Network ID Camera does not know which data is available and will display None for the COMM: field. The field data do not include the unit (kV mAs and so on). To add that an F-text field with the appropriate text has to be inserted after the COMM field.

2.2.3.2 The Senogrape.

The Senographe DMR provides a serial channel through which the KODAK Network ID Camera is connected.

The DMR has the serial channel built in but a rather expensive cable is needed to connect the camera. This cable is about 10m long and contains a isolator which electrically separates the Senographe from the KODAK Network ID Camera.

Additional an adaptor cable is needed to connect the GE provided cable from the Senographe to the KODAK Network ID Camera since both the GE cable and the KODAK Network ID Camera has 9-pin female connectors. This cable is made by connecting pin 2,3 and 5 between two 9pin male connectors.

Also, make sure that the software installed in the Senographe supports the DATAFLASH connection.

If the correct Senographe software and hardware are installed the Senographe will automatically configure it self for use with the KODAK Network ID Camera when the KODAK Network ID Camera is connected.

2.2.3.3 The KODAK Network ID Camera.

Support for exposure data from GE Senographe was added as standard in version 2.1 of the KODAK Network ID Camera software.

If the Senographe is ready you will only need a standard equipped KODAK Network ID Camera and a cable between the Senographe and KODAK Network ID Camera to make it work.

2.2.3.4 Post-installation test.

After installation the configuration should be carefully tested. For all parameters which presents values from a list it should be tested that all values will be presented. Remember that you are not only testing the configurartion of the camera but also that the Senographe is sending the correct value. For all numeric values you should make sure that the longest possible value is presented correctly (for example all five digits of the exposure time) and that the least significant digit is presented. Avoid if possible to use values like 2000. It is better to test with a value like 2318.

2.2.3.5 Cable between KODAK Network ID Camera and Senographe

Parts

2	DSUB 9 pin male connector
2	A shielded housing to the above
1	Shielded 3 wire cable

Connect the two connectors according to the folloing table.

9 pin male	9 pin male
2	2
3	3
5	5

2.2.4 GXDP-P/-NP

The General XRAY Data Protocol is a communication protocol intended to send xray exposure data from xray equipment to Kodak Network ID Camera. The protocol is designed to be flexible but still easy to implement. It was chosen to let the xray equipment always send all it's data in a specified format and let the Kodak Network ID Camera choose which data to display.

This specification divides the protocol into two layers where layer 1 is the transport protocol responsible for ensuring that the data reaches its destination unchanged and layer 2 is the data layer containing all the data. All communication is ASCII and control codes are used for special purposes.

The GXDP-P protocol has two phases. The poll phase and the data transfer phase.

The GXDP-NP protocol has only the data transfer phase included, i.e. not poll phase is performed.

We strongly recommends that the GXDP-P protocol is used because of its higher safety level.

2.2.4.1 Poll phase

NOTE! This phase is NOT included in the GXDP-NP protocol.

During normal operation the ID camera polls the xray equipment and gets an answer back. The purpose is to allow the ID camera to check that the connection is not broken and to be able to erase the data previously sent if that happens. If a single serial channel is used to connect either a printer or a ID camera the presence of polling can also be used by the xray equipment to detect that a ID camera is connected and not a printer.

The polling is performed by the camera sending ENQ (code 5) and should be acknowledged by the xray equipment by sending and ACK (code 6) within 3 seconds. The polling should be done at an interval not more then 5 seconds, 3 seconds is a recommended interval. Connection with the xray equipment should not be considered lost until three polls has failed. When connection cosidered lost, data previous sent will be erased from the camera.

Note that it may happen that the ID camera sends its ENQ after the xray equipment has started to send it's data message. As there is no synchronisation between the ID camera polling and the data transmission from the xray equipment this can not be prevented. Since the characters involved in the polling sequence are not used in the data transfer it is easy to separate data transfer from polling. After the data is sent and the xray equipment is waiting for the ACK from the ID camera, it may happen that the ID camera sends an ENQ before the ACK and this ENQ must be acknowledged by the xray equipment by sending an ACK within 3 seconds. At the end of this document there is a pseudo program showing one solution to this problem.

2.2.4.2 Data transfer phase

The data is sent in a block with the following format:

STX	Data area	CSUM	ETX
02H	1 to 100 chars	1 char	03H

Different checksums are used to ensure that GXDP-NP is not used on a system designed for GXDP-P.

The checksum CSUM for the GXDP-P protocol is a sum of all data bytes excluding STX and ETX modulo 96 plus 32 (CSUM=((add all chars of data area) MODULO 96) + 32.

The checksum CSUM for the GXDP-NP protocol is a sum of all data bytes excluding STX and ETX plus 10 modulo 96 plus 32 (CSUM=((add all chars of data area+10) MODULO 96) + 32.

The modulo 96 plus 32 means that the checksum is represented by the characters between 32 and 127 which are the printable characters of the 7-bin ASCII code. Note that adding the data of the data area and doing the modulo operation have to be performed using 16-bit operations.

2.2.4.3 Layer 2, data protocol

The data section consists of a list of data items and each item is represented by a number identifying the data followed by a value. Each data item is separated from the next by a semicolon ';' and the number is separated from the value by a colon.

Example:

```
"0:14;1: 2.4;2:Mo"
```

Unless there are any special reasons the value should be the value without unit, for example 7kV should be sent as 7.

The manufacturer of xray equipment should in a document present a list specifying which data is represented by which number and the maximum length of each item.

Example:

Number	Length	Description
0	2	kV
1	4	mAs
2	2	Anode (Rh/Mo)

If some data under some circumstances is not available the xray equipment may choose to omit that data item for that number.

Example:

```
"0:14;2:Mo"
```

The camera will reserve space for each of the data item it wants to display according to the maximum length specified for each of the data items. This has to be considered when designing the software of the xray equipment because the ID camera will show the value as sent from left to right. For most values (most notably numeric values) this calls for insertion of spaces before the value to keep the value right aligned within the field in the ID camera. In the example below the '1' and '10' are sent from the xray System and the 'kV' is printed by the camera.

We like it this way	Not this way
`  1kV` `10kV`	`1 kV` `10kV`

Since this specification does not deal with each kind of data we can not specify which data should be right and which should be left adjusted. Instead it is up to the designer of the xray equipment software to decide.

If international characters are needed the ISO8859-1 character table should be used. Kodak Network ID Camera supports ISO8859-1 but if some other equipment which do not use ISO8859-1 is designed to use this protocol, it should be made sure that the equipment does not fail if an character in the range 128 to 255 is sent to the ID camera.

2.2.4.4 Configuration of KODAK Network ID Camera.

Configuration of KODAK Network ID Camera for connection with a XRAY unit can be divided into two parts. One is to configure the serial channel for communication with the XRAY unit, the other is to create the picture that will be printed on the film.

The XRAY unit is connected to the AUX connector at the back of the KODAK Network ID Camera. The communication is set-up by entering set-up mode of the camera, please refer to the Installation and Setup Manual. When in the communication set-up, press the F1 key so that the word "Channel: AUX" is displayed in the upper rigth corner. The following parameters should be set according to the XRAY units parameters:

Baudrate
Parity
Databits

Select appropiate protocol, for example GXDP-P
Protocol GXDP-P

Creating the picture that will be printed on the film is done in the same way as usual except that there is one extra field type available. The COMM field type. When such a field is selected and enter is pressed an extra selection called COMM: appears in the window were you select which kind of exposure data should be displayed in the field. To build a picture you will have to define one COMM field for each exposure data to display. Note that before you do this, the communication must be configured otherwise the KODAK Network ID Camera does not know which data is available and will display None for the COMM: field. The field data do not include the unit (kV mAs and so on). To add that an F-text field with the appropriate text has to be inserted after the COMM field.

2.2.4.5 Post-installation test.

After installation the configuration should be carefully tested. For all parameters which presents values from a list it should be tested that all values will be presented. Remember that you are not only testing the configurartion of the camera but also that the XRAY unit is sending the correct value. For all numeric values you should make sure that the longest possible value is presented correctly (for example all five digits of the exposure time) and that the least significant digit is presented. Avoid if possible to use values like 2000. It is better to test with a value like 2318.

2.2.4.6 Pseudo program

ID Camera

Poll loop of the ID camera if GXDP-P protocol is used.

Every three to five seconds
    send ENQ to the xray equipment
If ACK is not received within 3 seconds then
    if this happens 3 times after each other consider the communication lost. Erase data stored.

Receiving program in the ID camera

If the character received is ACK and GXDP-P is used, tell the poll loop that ACK is received. This matches the ENQ.
If the character received is STX start receiving a data block from the xray equipment.
If the character received is ETX a complete block is received
    Take care of the data
If STX has been received before
    collect data
else
    discard the character

Xray equipment

Sending data to the ID camera

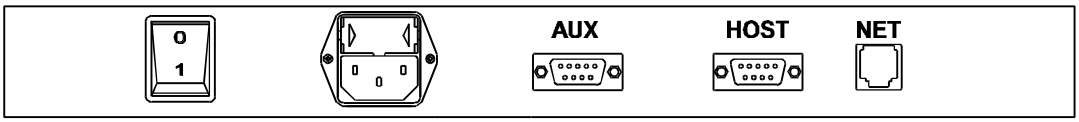
When there is data to send, send it and wait until the receiver program signals that an ACK or NAK has been received or until time-out.

Receiving program in the xray equipment

If the character is ACK
    Notify the data send section of the program
If the character is NAK
    Notify the data send section of the program
If the character is ENQ and GXDP-P is used.
Send ACK to the ID camera. Note that this must be sent within 3 seconds even if it is received while the xray equipment is sending data at the moment.

3 Physical connection.

On the back of the KODAK Network ID Camera there are three connectors for communication.

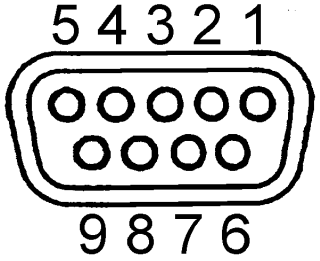


The AUX and HOST connectors are two RS232 interfaces. The NET connector contains one RS422/485 and one RS485 interface. The patient data download uses either the HOST connector or the RS422/485 interface. A X-ray unit must be connected to the AUX connector.

3.1 The HOST and AUX connector

These connectors are female 9-pin DB9 connectors. Their pinout is designed with the 9-pin connector used on PC compatibles in mind. If the KODAK Network ID Camera is to be connected to a PC compatible computer a pin-to-pin cable with a male connector on one end and a female connector on the other end can be used. If it will be connected to another host computer the following pin description can be used to make your own cable. Note that the name of the pins mentioned is what the pin should be connected to. Thus RxD is really an output from the camera.

Name	Direction	No
DCD	Out	1
RxD	Out	2
TxD	In	3
DTR	In	4
GND		5
DSR	Out	6
RTS	In	7
CTS	Out	8



Note that the KODAK Network ID Camera do not need any handshake signals to work. It sends out all handshake signals to the host computer but ignores any handshake input. If your host computer also ignores the handshake signals you will only need to connect the ground (pin 5) and the TxD (pin 3).

3.2 The NET Connector

This connector carries one RS422/485 (software selectable) and one RS485-only communication channel. When using this connector for patient data download only the RS422/485 channel is used in RS422 mode. This channel is called the HOST-RS422 below.

The connector is of the type RJ-45. It was selected because there are a lot of cable and connector material available for this kind of connector as it is also used to build LAN networks of type 10Base-T for personal computers. Normally this way is used to connect cameras to a host computer is when one host computer is connected to more then one camera but it may also be used if the distance between the host computer and camera is too long for RS232.

Next section will describe how to build an RS422 network using commonly available materials made for 10Base-T networks. Below follows the specification of the NET connector that may be needed if other material is used.

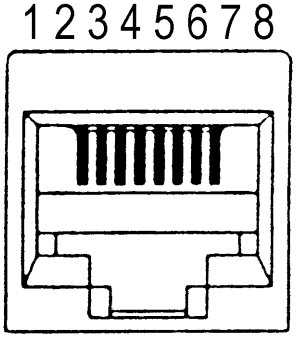
The pinout of the NET connector.

Pin	Used as:	Name
1	+ for the HOST RS422 output	Network Pair
2	- for the HOST RS422 output	Network Pair
3	GND	Network ground
4	+ for the HOST RS422 input and RS485 bi-directional	Network Pair
5	- for the HOST RS422 input and RS485 bi-directional	Network Pair
6	GND	Network ground
7	- external equipment RS485	External equipment pair
8	+ external equipment RS485	External equipment pair

There is a standard colour scheme used by most (all) connector and cable manufacturers, base colour first then the stripe colour.

1	White/Orange
2	Orange/White
3	White/Green
4	Blue/White
5	White/Blue
6	Green/White
7	White/Brown
8	Brown/White

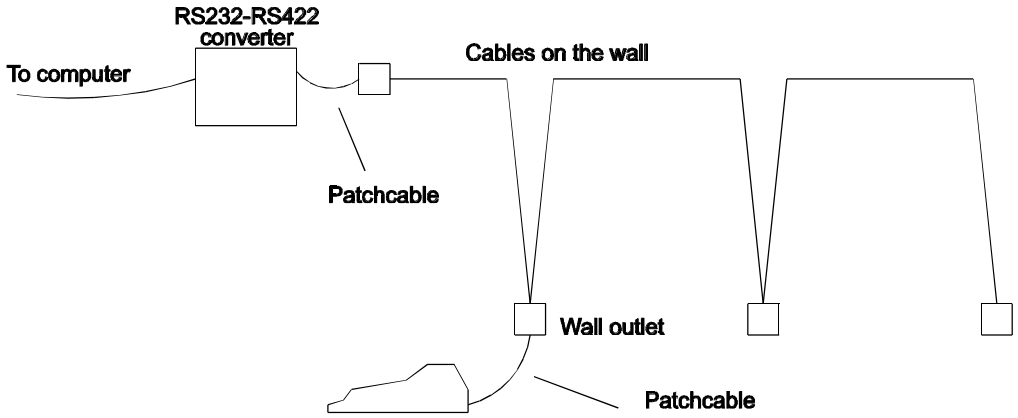
This is a picture with pin numbers of the female MOD8 connector found at the back of the camera.



Regardless of what is connected where, shielded connectors, patch cables and installation cables should be used. The cable should be a "4 pair STP" category 3 or 5. Unfortunately there does not seem to be any standard name for this equipment that can be referred to when buying. The only common description seems to be that it is the same equipment as is used for 10Base-T networks.

3.3 Building a RS422 Network

First let us look at a typical installation. In this case we assume that a cable network is to be installed in the building with a wall outlet at every camera. The camera is then connected through a cable (often called a patch cable) between the wall outlet and the camera.



The following materials are needed:

- One RS232 to RS422 converter unless the computer has a RS422 interface built in. It is strongly recommended that the converter should have LED's that indicates the status of the receive and transmit lines. They are a very good help if troubleshooting is needed.
- STP (shielded twisted pair) cable for the wall. A STP cable is made of four pairs of wires. The wires have a solid core, not made of thin copper wires spun together. This is an important feature to allow reliable connection with the outlets.
- One wall outlet for each camera. A very important aspect when selecting these is that they must allow connection of two wires per terminal. Many connectors only allow one wire per terminal. If two wires are connected it may work for a while but after some time (a year, maybe more, maybe less) the connection starts to oxide and the resistance of the connection increases, finally causing malfunction.
- One wall outlet of the same type as for the camera but for the RS232 to RS422 converter.
- A cable between each wall outlet and the cameras. This kind of cables are known as patch cables. It should be of the type STP (shielded twisted pair). There is another cable type commonly available which is a flat cable looking like cables often used by computer modems to connect to the telephone outlet but wider. They should not be used as the wires are not twisted. It is very important for RS422 that twisted pairs are used. One cable is also needed to connect to the RS232 to RS422 converter. Note that most converters do not have any RJ-45 connector but the best way to make the connection is to get an ordinary patch cable and cut the connector off in one end and connect it in what ever way the converter provides.
- An RS-232 cable between the computer and the RS232 to RS422 unit.

- A special tool to connect the wall cable to the wall outlet may be needed.

3.3.1 Installing Procedure

- Install the wall outlets on the wall preferable as close to the camera as possible.
- Install the cable on the wall. Do not put it close to high current mains cables.
- Connect the first wall-cable to the wall outlets according to the instructions that came with the wall outlets. Connect the second wall-cable to the wall outlets on top of the wires of the first cable. The normal procedure is to connect all four pairs but only the blue pair and the green pairs are used. The blue pair connects the transmission line and the green pair connects the communication ground between all cameras. You will easily see where to connect each pair but it may be hard to find out where the white and then coloured branch should be connected to but it really does not matter. What matters is that they are connected the same way in all connectors.
- Connect the patch cable to the RS232 to RS422 converter. Here you may notice that there is no RJ45 connector on the converter but we have still recommended using a patch cable. The reason is simply that a patch able is a good start, compared to mounting a RJ-45 plug to a cable. Cut off the RJ45 plug in one end and connect the wires in which ever way the converter provides:

Transmit+	Blue
Transmit-	White/blue
Ground	Both wires of the green pair

- Check if the converter can be configured to provide pull-up on the RS422 receive pair. If not pulled up it may happen that the converter interprets the unconnected RS422 receiver as active causing the receiver in the computer to always read something from the converter and some computers may not like this. There may be a LED on the unit that will show the status of the receive line. If this is a problem and no pull-up is provided the send line from the converter to the computer may be cut off as it is not needed.
- Connect all cameras to respective wall outlet with a patch cable.

3.3.2 Troubleshooting RS422

- Check if the computer is really sending something. Here the LED’s on the converter become handy.
- If the computer is not sending check if the handshake signals to the computer are not blocking transmission. Check that the cable between the computer and converter is made correctly, for example that receive and transmit are not swapped. Check if the software is supposed to send something. Do not take for granted that the software is properly installed. It may be a good idea to get help from the computer people. There are so many reasons for this problem that the problem should be turned over to them if the things mentioned above do not solve the problem.

- Check that you have selected the RS422 as the connection type in the communication set-up of the camera.
- Check baud rate, number of bits and parity.
- Check if the correct download protocol is used.
- If the download protocol is used, set the group name to nothing (blank). This will make the camera accept data for every patient. It will make sure that the problem is not that the group name is wrong or that no patient is booked for the room you are testing.
- Check if the software of the booking system is new or if there are any earlier installations that work. It may be that they have implemented the protocols for the first time and have not had the chance to test it with the camera yet.
- Enter the serial analyzer in the camera. Using this function you may see exactly what the booking system sends. If you can read patients names here and the camera still does not accept any patients there should be an error message in the system log or the wrong download protocol is selected. How to use the serial analyzer, please refer to chapter 3.4.1.
- Enter the system logger. Enable logging for communication, make the booking system send patients and check if any errors are logged. How to use the system logger, please refer to chapter 3.4.2.
- Measure the voltage between the sending pair (the blue pair). It should be a few volts. Or disconnect all cameras and the converter from the cable system and measure the resistance between the wires of the blue pair and between the blue and green pair. We have experienced a case when a cable fixing assembly in the wall outlet was incorrectly mounted and all wires of the cable were shorted in seven of the eleven outlets used in this installation.
- Short-circuit the blue pair in one end of the cable and measure at the other end. If the short circuit is not there the connection is broken somewhere. You may also short circuit the blue and green pair at one end and measure at the other end if the short circuit is there. This way the green pair can be checked. Remember to make sure that a short circuit is not there before you make one.

3.4 Built in diagnostic software

Kodak Network ID Camera is equipped with one serial analyzer and one system logger. Both are very usefull while troubleshooting communication problems.

3.4.1 Serial analyzer

The serial analyzer is displaying all data received on ether the HOST- or NET-Channel. The data is displayed both in HEX code and plain text using ISO 8859-1 character set.

The data displayed is read from the receiver buffer of the Kodak Network ID Camera which means that the serial analyzer should be invoked after the data has been sent to the camera.

If no communication has occured before entering the serial analyzer the window will look like this:

```
Serial Analyzer
 -32: 00 00 00 00 00 00 00 00
 -24: 00 00 00 00 00 00 00 00
 -16: 00 00 00 00 00 00 00 00
  -8: 00 00 00 00 00 00 00 00
   0: 00 00 00 00 00 00 00 00
Refresh                        Exit
```

The soft-keys are used as follow.

`Refresh` To updata the window. If any communication is received while the analyzer window is open a refresh must be done manually.

`Exit` To exit the serial analyzer.

`Clear Buf` By pressing shift+F1 all data stored in the analyzer will be erased.

To scroll the window up and down, use the arrow-keys.

The serial analyzer window is displaying negative buffer addresses, these are not used and should be ignored. The first byte sent to the camera will be displayed on position ”0” next one on position ”1” and so on. If a record of bytes are received the last 40 bytes will be displayed after refresh. By scrolling the window earlier bytes can be displayed.

The buffer size is 8k byte and when it is full it will ”wrap over”. This means that the analyzer can display the latest 8kBytes received. **NOTE!** If more than 8kBytes is sent to the camera in one transmission the first bytes will be overwritten by the last one.

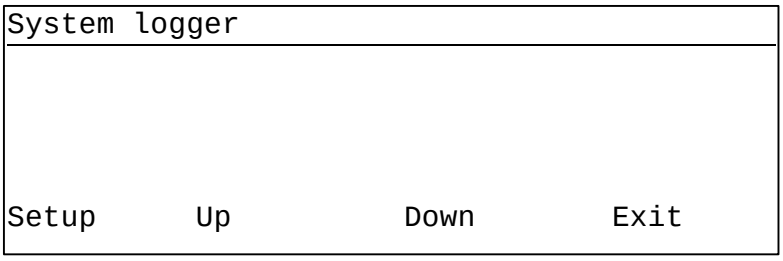
3.4.2 System logger

The system logger is a 64 record data base where the firmware can report errors and abnormal situations which are not reported to the operator or which may be useful for technicians to check afterwards. The logger is never erased unless the ”Erase” button is pressed. Together with the message, date- and timestamp is stored. The format of a record is ”`No:Date Time Error`”.

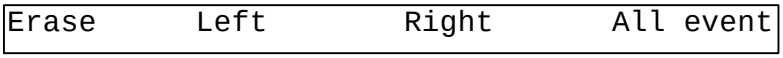
`No` index between 00 - 63.
`Date` Date when the error occured.
`Time` Time when the error occured.
`Error` The error message in plain text.

ex. ”`00:100499 08:45 Faild to open lid. Pos = 20`”.

The errors are divided into four groups, Miscellaneous-, Communication-, Mechanical and Critical errors. The three first can be set to Record/Ignored under setup. The last one is allways active because it handle internal critical errors such as the set-up stored in the flash memory has been erased and checksum error in memory.



Press shift-key to enable the following functions.



The soft-keys are used as follow.

`Setup` Enter the system logger setup. Possible settings are enable/disable of recording of Miscellaneous-, Communication- and Mechanical errors. If, for example, a communication problem which occur rarely shall be traced it can be a good idee to switch the other records of to avoid that the communication records gets overwritten if the database gets full. This because of the limeted number of records in the list. **NOTE!** Recording of critical errors can not be switched of.

`Up` Scroll the window up.

`Down` Scroll the window down.

`Exit` Exit the system logger.

`Erase` Clear all error messages listed in the system logger. **NOTE!** If the list is deleted, the data can not be re-created.

`Left` Scroll the window to the left.

`Rignt` Scroll the window to the right.

`All event` View all records. This can be used if the database is partly corrupt and you want to view all records even the records which the camera consider being after its endmark. Empty records is marked with lines.

Appendix A

ISO-8859-1 Character set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
A		¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	-	®	¯
B	°	±	²	³	´	µ	¶	·	¸	¹	º	»	¼	½	¾	¿
C	À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î	Ï
D	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û	Ü	Ý	Þ	ß
E	à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î	ï
F	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù	ú	û	ü	ý	þ	ÿ

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Publication No. XP 3478
APRIL 99