Bucky Connection and Troubleshooting Guide

Introduction

This document has been created to serve two purposes:
1. As a quick and easy reference on how to connect different types of buckys to our equipment.
2. As an educational document explaining essential concepts that will assist Field Service Engineers to:
   • hook up any bucky to any generator
   • troubleshoot failures of the bucky interface

The Basic Interface

There are three elemental parts of the interface between an x-ray generator and a bucky.
• Power
  • A signal that comes from the generator to start the grid moving
  • A signal sent back to the generator which allows the x-ray exposure to begin.

The number of wires used to make these connections can change; however, the three basic elements of the interface always remain the same. The following text and tables describe these basic signals:

Table 1: The Basic Bucky Interface

<table>
<thead>
<tr>
<th>Basic Signal Type</th>
<th>Comes From</th>
<th>Goes To</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Generator</td>
<td>Bucky</td>
<td>For our equipment this is always 120 VAC and 120 VAC Return (Neutral).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note: Some bucky types have a selectable power input of 120 or 240 VAC,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>make sure it’s set to 120 VAC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Note:</td>
</tr>
<tr>
<td>Start the grid moving.</td>
<td>Generator</td>
<td>Bucky</td>
<td>This signal is usually 120 Volts AC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(L-F Par Speed Buckys use this signal as power to drive the grid)</td>
</tr>
<tr>
<td>Start the x-ray exposure.</td>
<td>Bucky</td>
<td>Generator</td>
<td>Can be 120 Volts AC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Can also be an isolated relay contact. (See Table 2 on page 2)</td>
</tr>
</tbody>
</table>
The Basic Elements

Power:

The power to the bucky is used for the following purposes:
1. To drive the grid motor and provide power to other internal circuits.
2. To drive the ACL (automatic cassette loader) portion of a LF 9000 Bucky.
3. To drive input and output signals to the generator.

Start Grid Motion:

The signal to start the grid moving occurs when x-ray is requested by the operator. This usually becomes active immediately upon pressing the “X-Ray” or “Expose” button on the operators control panel. In the most simple type of interface, this signal also provides the power to the bucky.

Start (Enable) Exposure:

A short time after the grid starts to oscillate, the bucky sends a signal back to the generator, telling it to begin the exposure. This action delays the exposure until the grid is moving. This ensures that the grid is moving when the exposure starts and reduces the chance that the grid will be visible on the radiograph.

Our X-Ray generators require one of two different types of exposure start signals: one that needs an AC voltage input and one that needs an isolated contact closure. Refer to the following table:

<table>
<thead>
<tr>
<th>Type of Generator</th>
<th>Required Signal Input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gendex-Del / Universal High Frequency</td>
<td>Isolated Relay Contact</td>
</tr>
<tr>
<td>(e.g.: MP500, GX525, AP 500, ATC 725, etc.)</td>
<td>This type of interface uses a low voltage, DC circuit to command the microprocessor in the generator to start the exposure. The isolated contact completes a circuit that turns on an opto-coupler.</td>
</tr>
<tr>
<td>Basic Single Phase</td>
<td>120 VAC</td>
</tr>
<tr>
<td>(e.g.: X-TEK, UNIMATIC, etc.)</td>
<td>This type of interface sends the bucky input power back to the generator to close a relay and start the exposure.</td>
</tr>
</tbody>
</table>
**Signal Nomenclature**

Common terminal names are use by many manufacturers of generators and buckys alike; however, even if the names are the same, the signals that ride on those terminals can be very different.

The following table illustrates the *dramatic* difference of signal names used on different types of devices:

<table>
<thead>
<tr>
<th>Function</th>
<th>Device</th>
<th>Start the x-ray exposure (into generator)</th>
<th>Start the x-ray exposure (into bucky)</th>
<th>Start the grid moving.</th>
<th>120 VAC Power</th>
<th>Power Return</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AP / ATC</strong></td>
<td></td>
<td>FB</td>
<td>CKT COM</td>
<td>SEL</td>
<td>117VAC</td>
<td>117VAC COM</td>
</tr>
<tr>
<td><strong>MP / GX</strong></td>
<td></td>
<td>Exp. Release</td>
<td>Exp. Release Return</td>
<td>120 VAC BUCKY ON</td>
<td>120 VAC BUCKY RESET</td>
<td>120 VAC RET.</td>
</tr>
<tr>
<td>(names from I/O PCB schematic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unimatic</td>
<td></td>
<td>B1 (120 VAC)</td>
<td>B2 (120 VAC)</td>
<td>B3 (120 VAC)</td>
<td>B4</td>
<td>F1</td>
</tr>
<tr>
<td>X-Tek 400</td>
<td></td>
<td>B1 (+24vdc)</td>
<td>B2 (+24vdc)</td>
<td>B3 (0 VAC)</td>
<td>B4</td>
<td>B8</td>
</tr>
<tr>
<td>LF Par Speed</td>
<td></td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>-- n/a --</td>
<td>B4</td>
</tr>
<tr>
<td>LF Super Speed</td>
<td></td>
<td>B1</td>
<td>B2</td>
<td>B3</td>
<td>B8</td>
<td>B4</td>
</tr>
<tr>
<td>LF 8000-9000 &amp; Progeny True Speed</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>L</td>
<td>N</td>
</tr>
<tr>
<td>Midwest 14 x 36</td>
<td></td>
<td>B2</td>
<td>-- n/a --</td>
<td>B1</td>
<td>B3</td>
<td>B4</td>
</tr>
<tr>
<td>Universal / Gendex 14x36</td>
<td></td>
<td>B1</td>
<td>-- n/a --</td>
<td>B3</td>
<td>S1</td>
<td>B4</td>
</tr>
<tr>
<td>(made by Midwest)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Troubleshooting the Interface

NOTE: If problems occur upon installation, use the connection diagrams in the following section to ensure proper interface wiring prior to using this troubleshooting procedure.

The following diagram is provided to assist in troubleshooting any bucky interface. Each of the significant blocks are numbered and those numbers correspond the following numbered paragraphs.

Figure 1: Troubleshooting Flow Chart
1. If no exposure occurs when one of the buckys in an X-Ray system is selected, the problem is most likely in the bucky interface. The purpose of the interface is to:
   • start the grid moving at the appropriate instant
   • delay the exposure until the grid is moving

   If there is any failure in the interface the symptom will most likely be “no exposure”.
   If an exposure occurs but the grid does not move, the most likely cause would be incorrect wiring of the interface. In this case, use the connection diagrams in the following section to ensure proper interface wiring.

2. If the grid oscillates upon “expose”, it can be certain that half of the interface is functional.

3. The “exposure enable” output from the bucky can be different depending on the manufacturer and model of the bucky. Most buckys provide an isolated contact closure which redirects a current (which comes from the generator) back to the generator. Refer to the manufacturer’s documentation. For the Midwest (or Universal-Gendex) 14 x 36 bucky, refer to “Midwest Bucky Schematic” on page 6

4. Cable failure can be caused by excessive bending, rubbing or by accidental severance. The connections can fail from a poor crimp on a connector or a loose terminal screw.

5. The “bucky select” output circuit in the generator is the circuit that sends a signal to the bucky to start the grid moving. This circuit sends the signal upon the exposure command. The signal is usually 120VAC but in some cases it is 0 VAC. See Table 3, “Bucky / Generator Terminal Names by Function,” on page 3

6. The exposure enable input circuit in the generator may use a simple relay to pass an exposure signal. It is also possible that it uses a complex set of relays, optical encoders, and microprocessor signals. Refer to the X-Ray generator’s service documentation to troubleshoot this circuit.
LS-X and LS-M are mechanically held open when the grid is in the "home" position. When 120 VAC is input to the X-Ray In signal, Relay B energizes and provides current to the motor through its terminal 9 and also provides 115 VAC potential to terminal A of relay A. As the grid begins to move, LS-M and LS-X close and energize Relay A which self-latches through its terminals 4 & 7 and 6 & 9.

The closure of LS-X also provides a 115VAC signal out to the generator to start the exposure via Relay B terminals 4 & 7. When the "X-Ray In" signal is removed by the generator, Relay B de-energizes, but the motor still turns because Relay A is still self-latched. When the grid returns to its home position LS-M opens which de-energizes Relay A and removes power from the motor.
Bucky Interface Wiring Diagrams

Use the diagrams on the following pages for specific generator to bucky interface wiring.

“AP or ATC Generator to L-F Par Speed Bucky” on page 8
“AP or ATC Generator to L-F Super Speed Bucky” on page 9
“AP or ATC Generator to L-F 8000 & 9000 or Progeny True Speed Bucky” on page 10
“AP or ATC Generator to Midwest 14 x 36 Bucky” on page 11
“AP or ATC Generator to Universal/Gendex 14 x 36 Bucky (made by Midwest)” on page 12
“AP or ATC Generator to Hans Pausch Bucky” on page 13
“MP or GX (stand alone) to L-F Par Speed Bucky” on page 14
“MP or GX (stand alone) to L-F Super Speed Bucky” on page 15
“MP or GX (stand alone) to L-F 8000 & 9000 or Progeny True Speed Bucky” on page 16
“MP or GX (stand alone) to Midwest 14 x 36 Bucky” on page 17
“MP or GX (stand alone) to Universal/Gendex 14 x 36 Bucky (made by Midwest)” on page 18
“MP or GX (in table) to L-F Par Speed” on page 19
“MP or GX (in table) to L-F Super Speed” on page 20
“MP or GX (in table) to L-F 8000 & 9000 or Progeny True Speed Bucky” on page 21
“MP or GX (in table) to Midwest 14 x 36 Bucky” on page 22
“MP or GX (in table) to Universal/Gendex 14 x 36 Bucky (made by Midwest)” on page 23
“Unimatic 325D Generator to L-F Par Speed Bucky” on page 24
“Unimatic 325D Generator to L-F Super Speed Bucky” on page 25
“Unimatic 325D to L-F 8000 & 9000 or Progeny True Speed Bucky” on page 26
“Unimatic 325D to Midwest 14 x 36 Bucky” on page 27
“Unimatic 325D to Universal/Gendex 14 x 36 Bucky made by Midwest)” on page 28
“X-Tek 400 Generator to L-F Par Speed Bucky” on page 29
“X-Tek 400 Generator to L-F Super Speed Bucky” on page 30
“X-Tek 400 Generator to L-F 8000 & 9000 or Progeny True Speed Bucky” on page 31
“X-Tek 400 Generator to Midwest 14 x 36 Bucky” on page 32
“X-Tek 400 Generator to Universal/Gendex 14 x 36 Bucky (made by Midwest)” on page 33
Figure 3: AP or ATC Generator to L-F Par Speed Bucky

AP or ATC

- TB4-1: 120 VAC Upon Expose
- TB4-2: Wall FB
- TB4-3: N/C
- TB4-4: CKT Common
- TB4-5: 120 VAC Return

L-F PAR Speed

- B3: WALL BUCKY
- B2
- B1
- B4

TABLE

- TB5-1: 120 VAC Upon Expose
- TB5-2: Table FB
- TB5-3: N/C
- TB5-4: CKT Common
- TB5-5: 120 VAC Return

B4

B1

B2

B3
Figure 4: AP or ATC Generator to L-F Super Speed Bucky
Figure 5: AP or ATC Generator to L-F 8000 & 9000 or Progeny True Speed Bucky
Figure 6: AP or ATC Generator to Midwest 14 x 36 Bucky

Diagram:
- AP or ATC
- Relay
- Isolated Contact
- 120 VAC Coil
- 120 VAC When Grid is Moving
- 120 VAC Upon Expose
- 120 VAC Return

Connections:
- TB4-1 to B1
- TB4-2
- TB4-3 to B3
- TB4-4
- TB4-5 to B4
- B2
- B3
- B4

Connections for 120 VAC:
- 120 VAC when Grid is Moving
- 120 VAC Upon Expose
- 120 VAC Return
Figure 7: AP or ATC Generator to Universal/Gendex 14 x 36 Bucky (made by Midwest)
Figure 8: AP or ATC Generator to Hans Pausch Bucky
Figure 9: MP or GX (stand alone) to L-F Par Speed Bucky

- MP or GX
- TB1-12 N/C
- TB1-11 120 VAC Return
- TB1-10 120 VAC Upon Expose
- TB1-9 DC Return
- TB1-8 Exposure Enable
- TB1-5 N/C
- TB1-4 120 VAC Return
- TB1-3 120 VAC Upon Expose
- TB1-2 DC Return
- TB1-1 Exposure Enable

L-F Par Speed

WALL BUCKY

TABLE BUCKY
Figure 10: MP or GX (stand alone) to L-F Super Speed Bucky
Figure 11: MP or GX (stand alone) to L-F 8000 & 9000 or Progeny True Speed Bucky

[Diagram showing connections for MP or GX to L-F 8000 & 9000 or Progeny True Speed Bucky including TB1-1 to TB1-12 with labels for 120 VAC, 120 VAC Return, Upon Expose, DC Return, Exposure Enable, and WALL BUCKY and TABLE BUCKY connections.]
Figure 12: MP or GX (stand alone) to Midwest 14 X 36 Bucky
Figure 13: MP or GX (stand alone) to Universal/Gendex 14 x 36 Bucky (made by Midwest)
Figure 14: MP or GX (in table) to L-F Par Speed

MP or GX

TB3-5 — N/C
TB3-4
TB3-3
TB3-2
TB3-1

L-F Par Speed

B4
B3
B2
B1

WALL BUCKY

TB2-5 — N/C
TB2-4
TB2-3
TB2-2
TB2-1

NON-ELEVATING TABLE WIRING HARNESS

Exposure Enable

120 VAC Return
120 VAC Upon Expose
DC Return
Exposure Enable

120 VAC Return
120 VAC Upon Expose
DC Return
Exposure Enable

TABLE BUCKY
Figure 15: MP or GX (in table) to L-F Super Speed

MP or GX
(In Table)

L-F Super Speed

120 VAC

120 VAC Return

120 VAC

Upon Expose

DC Return

Exposure Enable

TB3-5

TB3-4

TB3-3

TB3-2

TB3-1

TB2-5

TB2-4

TB2-3

TB2-2

TB2-1

120 VAC

120 VAC Return

120 VAC

Upon Expose

DC Return

Exposure Enable

B8

B4

B3

B2

B1

WALL BUCKY

TABLE BUCKY

NON-ELEVATING TABLE WIRING HARNESS
Figure 16: MP or GX (in table) to L-F 8000 & 9000 or Progeny True Speed Bucky

```
MP or GX
(In Table)

TB3-5 120 VAC
TB3-4 120 VAC Return
TB3-3 120 VAC Upon Expose
TB3-2 DC Return
TB3-1 Exposure Enable

L-F 8000 & 9000 or Progeny True Speed

L
N
3
2
1

WALL BUCKY

TB2-5 120 VAC
TB2-4 120 VAC Return
TB2-3 120 VAC Upon Expose
TB2-2 DC Return
TB2-1 Exposure Enable

TABLE BUCKY
```
Figure 17: MP or GX (in table) to Midwest 14 x 36 Bucky

[Diagram showing the connection and troubleshooting of MP or GX to a Midwest 14x36 Bucky. The diagram includes labels for TB3-1, TB3-2, TB3-3, TB3-4, TB3-5, COIL, Relay, and isolated contact. Connections are indicated with 120 VAC Upon Expose and 120 VAC Return.]
Figure 18: MP or GX (in table) to Universal/Gendex 14 x 36 Bucky (made by Midwest)

![Diagram of MP or GX to Universal/Gendex 14 x 36 Bucky](image-url)
Figure 19: Unimatic 325D Generator to L-F Par Speed Bucky

Unimatic 325D

B1
B2
B3
F1

120 VAC When Grid is Moving

Lieble Par Speed

B1
B2
B3
B4

120 VAC Upon Expose
120 VAC Upon Expose
120 VAC Return
Figure 20: Unimatic 325D Generator to L-F Super Speed Bucky

Unimatic 325D

B1
B2
B3
F1
B4

Grid is Moving
Upon Expose
Upon Expose
Return

L-F Super Speed

B1
B2
B3
B4
B8

120 VAC When
120 VAC
120 VAC
120 VAC
120 VAC
Figure 21: Unimatic 325D to L-F 8000 & 9000 or Progeny True Speed Bucky

Diagram:

Unimatic 325D

- B1: 120 VAC When Grid is Moving
- B2: 120 VAC Upon Expose
- B3: 120 VAC Upon Expose
- B4: Jumper
- F1: 120 VAC Return

L-F 8000 & 9000 or Progeny True Speed

- 1: 120 VAC
- 2: 120 VAC
- 3: 120 VAC
- N: Return
- L: Grid is Moving
Figure 22: Unimatic 325D to Midwest 14 x 36 Bucky

Unimatic 325D

- B1
- B2
- B3
- F1
- B4

Midwest 14 X 36

- B2
- B1
- B4
- B3

Connections:
- B1 → B2: 120 VAC When Grid is Moving
- B2 → B3: N/C
- B3 → F1: 120 VAC Upon Expose
- F1 → B4: 120 VAC Return
- B4 → B3: 120 VAC

Jumper

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Figure 23: Unimatic 325D to Universal/Gendex 14 x 36 Bucky made by Midwest

Unimatic 325D

Unimatic 325D

Universal / Gendex
14 X 36
(made by Midwest)

B1

B2

B3

F1

B4

Universal / Gendex
14 X 36
(made by Midwest)

B1

B2

B4

S1

120 VAC When Grid is Moving

120 VAC Upon Expose

120 VAC Return

120 VAC

N/C

Jumper
Figure 24: X-Tek 400 Generator to L-F Par Speed Bucky
Figure 25: X-Tek 400 Generator to L-F Super Speed Bucky
Figure 26: X-Tek 400 Generator to L-F 8000 & 9000 or Progeny True Speed Bucky

<table>
<thead>
<tr>
<th>X-Tek 400</th>
<th>L-F 8000 &amp; 9000 or Progeny True Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS3-14</td>
<td>N</td>
</tr>
<tr>
<td>TS3-11</td>
<td>L</td>
</tr>
<tr>
<td>TS3-16</td>
<td>3</td>
</tr>
<tr>
<td>TS3-20</td>
<td>2</td>
</tr>
<tr>
<td>TS3-18</td>
<td>1</td>
</tr>
<tr>
<td>TS3-13</td>
<td>N</td>
</tr>
<tr>
<td>TS3-10</td>
<td>L</td>
</tr>
<tr>
<td>TS3-15</td>
<td>3</td>
</tr>
<tr>
<td>TS3-19</td>
<td>2</td>
</tr>
<tr>
<td>TS3-17</td>
<td>1</td>
</tr>
</tbody>
</table>

120 VAC

120 VAC Return

"0" VAC Upon Expose

+24VDC on "Ready"

Exposure Enable

WALL BUCKY

TABLE BUCKY

+24VDC on "Ready"
Figure 27: X-Tek 400 Generator to Midwest 14 x 36 Bucky

- TS3-16 "0" VAC Upon Expose
- TS3-20
- TS3-11 120 VAC Return
- TS3-18
- TS3-14 120 VAC
- "0" VAC When Grid is Moving

Midwest 14x36 Bucky

- B1
- B3
- B4
- B2

120 VAC Coil

Isolated Contact

Relay
Figure 28: X-Tek 400 Generator to Universal/Gendex 14 x 36 Bucky (made by Midwest)