

# Chapter 59

## FGS Engineering

In this chapter...

### 59.1 Introduction

The FGS Engineering templates are used for calibration and engineering activities for the FGS detectors. These operations may be to obtain imaging observations, external flats, internal flats, and focus observations. The parameters described in this section are used to specify the Observations for FGS Engineering. More complete descriptions of the detector readout parameters, filters, detector characteristics, etc. are available in the [FGS Instrument Handbook](#).

The following fields are defined in Chapter 5: Observation Number (5.1), Observation Label (5.2), Observation Comments (5.3), and Observation-Level Special Requirements (5.5), and will not be discussed in this Chapter.

The FGS Engineering templates consist of the following parameters:

Field	Details	Values	Notes
<b>Imaging [FGS0006]</b>			
Target Name <b>[FGS0007]</b>	select Target Name	choose from list <b>[FGS0022]</b>	from Target list
Primary Dithers <b>[FGS0023]</b>	select number of steps	choose from list <b>[FGS0024]</b>	
Subpixel Positions <b>[FGS0025]</b>	select number of secondary dither positions	choose from list <b>[FGS0037]</b>	
Detector <b>[FGS0027]</b>	select Detector	GUIDER1, GUIDER2 <b>[FGS0038]</b>	
Readout Pattern <b>[FGS0039]</b>	specify readout pattern	FGS, FGSRAPID <b>[FGS0040]</b>	
Number of Groups <b>[FGS0041]</b>	specify number of groups	Number <b>[FGS0042]</b>	
Number of Integrations <b>[FGS0043]</b>	specify number of integrations	Number <b>[FGS0044]</b>	

<b>External Flat [FGS0045]</b>			
Detector <b>[FGS0046]</b>	Readout Pattern	specify readout pattern <b>[FGS0047]</b>	
Readout Pattern <b>[FGS0048]</b>	specify readout pattern	FGS, FGSRAPID <b>[FGS0049]</b>	
Number of Groups <b>[FGS0050]</b>	specify number of groups	Number <b>[FGS0051]</b>	
Number of Integrations <b>[FGS0052]</b>	specify number of integrations	Number <b>[FGS0053]</b>	
<b>Internal Flat [FGS0054]</b>			
Target Name <b>[FGS0055]</b>	select Target Name	choose from list <b>[FGS0056]</b>	from Target list
Calibration Type <b>[FGS0057]</b>	select Calibration Type	FULLONLY, WITHSUBARRAYS <b>[FGS0058]</b>	
Detector <b>[FGS0059]</b>	select Detector	GUIDER1, GUIDER2 <b>[FGS0060]</b>	
<b>Focus [FGS0001]</b>			
Target Name <b>[FGS0002]</b>	select Target Name	choose from list <b>[FGS0003]</b>	from Target list
Detector <b>[FGS0004]</b>	select Detector	GUIDER1, GUIDER2 <b>[FGS0005]</b>	
Readout Pattern <b>[FGS0008]</b>	specify readout pattern	TFIG, TFIGRAPID <b>[FGS0009]</b>	see <b>Error!</b> <b>Reference</b> <b>source not</b> <b>found.</b>
Number of Groups <b>[FGS0010]</b>	specify number of groups	Number <b>[FGS0011]</b>	
Number of Integrations <b>[FGS0012]</b>	specify number of integrations	number (1-10) <b>[FGS0013]</b>	
Relative Positions <b>[FGS0014]</b>	specify array of positions	array of 1-20 positions <b>[FGS0015]</b>	

## 59.2 Imaging

### 59.2.1 Target Name

Select the TARGET NAME **[TBD]** from the list of targets previously entered **[FGS0061]** (see [Section 5.8](#)).

## 59.2.2 Dither Patterns

Most observations with JWST will require dithering. The following parameters define the dither pattern for FGS Imaging.

### 59.2.2.1 Primary Dithers

**PRIMARY DITHERS** [**PRIMARY\_DITHERS**] = 1, 2, 3, 4, 5, 6, 7, 8, . . . 23, 24, 25 [**FGS0062**]

This parameter specifies the number of primary dither points.

### 59.2.2.2 Subpixel Positions

**SUBPIXEL POSITIONS** [**SUBPIXEL\_POSITIONS**] = 1 [**FGS0063**], 4 [**FGS0064**]

This parameter specifies the secondary dither points used for every primary dither point [**FGS0065**].

Note that selecting a value of 1 for both PRIMARY DITHERS and SUBPIXEL POSITIONS will result in a single image with no offset images [**FGS0066**].

Note for developers: see Appendix F4 for dithering details.

## 59.2.3 Detector

**DETECTOR** [**DETECTOR**] = GUIDER1 [**FGS0067**], GUIDER2 [**FGS0068**]

This field specifies the **DETECTOR** to be used to obtain the data.

## 59.2.4 Exposure Duration

The following parameters define the Imaging exposure.

### 59.2.4.1 Readout Pattern

**READOUT PATTERN** [**READOUT\_PATTERN**] = FGS [**FGS0069**], FGSRAPID [**FGS0070**]

This field specifies the readout pattern to be used to obtain the data.

#### 59.2.4.2 Number of Groups

**NUMBER OF GROUPS [NGROUPS]** specifies the number of groups in an integration **[FGS0071]**.

#### 59.2.4.3 Number of Integrations

**NUMBER OF INTEGRATIONS [NINTS]** field specifies the number of times the integration is repeated **[FGS0072]**.

### 59.3 External Flat

These parameters are required to obtain External (Sky) Flat observations. Note that this type of observation will be obtained as a parallel to normal science observations on other SIs. To obtain an FGS external flat observation that is not performed in parallel, specify an FGS Imaging observation with the dithering parameters set so that only a single pointing is used.

#### 59.3.1 Detector

**DETECTOR [DETECTOR] = GUIDER1 [FGS0073], GUIDER2 [FGS0074]**

This field specifies the **DETECTOR** to be used to obtain the data.

#### 59.3.2 Exposure Duration

The following parameters define the external flat exposure.

##### 59.3.2.1 Readout Pattern

**READOUT PATTERN [READOUT PATTERN] = FGS [FGS0075], FGSRAPID [FGS0076]**

This field specifies the readout pattern to be used to obtain the data.

##### 59.3.2.2 Number of Groups

**NUMBER OF GROUPS [NGROUPS]** specifies the number of groups in an integration **[FGS00677]**.

### 59.3.2.3 Number of Integrations

**NUMBER OF INTEGRATIONS** [**NINTS**] field specifies the number of times the integration is repeated [**FGS0078**].

## 59.4 Internal Flat

These parameters are required to obtain Internal Flat observations. Note that this type of observation cannot be obtained as a parallel to normal science observations [**FGS0079**]. There is an implicit PCSMODE of COARSE for these observations [**FGS0080**].

Internal flats are obtained with illumination from one of the FGS calibration lamps (although the sky is being detected since there is no shutter). Exposures with predefined parameters are taken at each pointing in a predefined 3-point dither pattern [**FGS0081**].

### 59.4.1 Target Name

Select the **TARGET NAME** [**TBD**] from the list of targets previously entered [**FGS0082**] (see [Section 5.8](#)).

### 59.4.2 Calibration Type

**CALIBRATION TYPE** [**CALIB\_TYPE**] = **FULLONLY** [**FGS0083**],  
**WITHSUBARRAYS** [**FGS0084**]

This field specifies the calibration type to be performed. If **FULLONLY** is selected, only full-frame exposures will be taken [**FGS0085**]. If **WITHSUBARRAYS** is selected, exposures of a set of 9 calibration subarrays will also be taken along with the full-frame exposures at each pointing in the dither pattern [**FGS0086**].

### 59.4.3 Detector

**DETECTOR** [**DETECTOR**] = **GUIDER1** [**FGS0087**], **GUIDER2** [**FGS0088**]

This field specifies the **DETECTOR** to be used to obtain the data.

## 59.5 Focus

These parameters are required to obtain Focus observations. Note that this type of observation cannot be obtained as a parallel to normal science observations. [**FGS0016**]

The focusing mechanism will be scanned through a specified number of relative positions centered on the expected focus, and then returned to the starting position. At each point in the focus sweep, a wide-band image will be obtained for analysis. If only one position is specified, the focus is maintained at this new position (i.e. the focus is reset).

### **59.5.1 Target Name**

Select the **TARGET NAME** **[TBD]** from the list of targets previously entered (see [Section 5.8](#)).

### **59.5.2 Detector**

**DETECTOR** **[DETECTOR]** = **GUIDER1** **[FGS0017]**, **GUIDER2** **[FGS0018]**

This field specifies the **DETECTOR** to be used to obtain the data.

### **59.5.3 Exposure Duration**

The following parameters define the focus exposure.

#### **59.5.3.1 Readout Pattern**

**READOUT PATTERN** **[READOUT PATTERN]** = **FGS** **[FGS0020]**, **FGSRAPID** **[FGS0021]**

This field specifies the readout pattern to be used to obtain the data.

#### **59.5.3.2 Number of Groups**

**NUMBER OF GROUPS** **[NGROUPS]** specifies the number of groups in an integration **[FGS0026]**.

#### **59.5.3.3 Number of Integrations**

**NUMBER OF INTEGRATIONS** **[NINTS]** field specifies the number of times the integration is repeated **[FGS0028]**.

### **59.5.4 Relative Positions**

The **RELATIVE POSITION** **[DELARRAY]** parameter specifies an array of 1 to 20 positions that the focus is to be moved to **[FGS0029]**; note that each position must be unique **[FGS0036]** (i.e. a given value can only appear once in the list). The positions are given in millimeters (range +28.0 **[FGS0030]** to -28.0 **[FGS0031]**.) in the OTE frame, and are offsets from the current position. The exact order in which the positions will be executed will be determined by the onboard scripts. There are 3 unique cases:

1. to perform a focus sweep (returning to the original focus), enter from 2 to 20 positions **[FGS0032]**.
2. to reset the focus, specify only 1 position **[FGS0033]**.
3. to use the default scan (10 steps of 0.4mm from -2.0 to +2.0), select the checkbox **[FGS0034]**.

Note for developers: when the checkbox for default scan is selected, the Relative Position input area should be inactive. **[FGS0035]**.